USSR Report

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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USSR REPORT

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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COMPUTER TECHNOLOGY AT NEW LEVEL

Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRANCHLENOV SEV in Russian No 11, Nov 84, pp 14-18

[Excerpts from article by Igor Danil'chenko, doctor of technical sciences and director of the Intergovernmental Commission on Computer Technology Coordination Center]

[Excerpts] Fifteen years ago, in December 1969, the governments of the People's Republic of Bulgaria, the Hungarian People's Republic, the German Democratic Republic, the Polish People's Republic, the USSR and the Czechoslovak Socialist Republic signed a multilateral agreement on cooperation in the area of development, production and use of computer technology. In 1972, Cuba joined the agreement, as did the Socialist Republic of Romania in 1973. The goal of the agreement was to unify the efforts of scientific, design and production collectives of brother countries in order to create in a short period a Unified System for third generation computers.

In order to implement the agreement and lead and coordinate the work, the Intergovernmental Commission on Cooperation of Socialists Countries in the Area of Computer Technology was formed, consisting of national sections formed by the governments of the cooperating countries.

Thanks to combining efforts, in a short time there was success in developing and organizing series production and providing for the planned introduction of many hundreds of types of articles for the Unified System of computers, the SM minicomputer systems and microprocessor technology.

From 1970 to 1983, 467 complex, modern computer hardware devices and corresponding software were created and jointly tested and assimilated. The technological parameters of the computers, created within the framework of cooperation over the past 15 years, have improved by a factor of 100.

At the present time, under the auspices of the Intergovernmental Commission on Computer Technology, computer devices from 8-16 bit micro- and minicomputers to powerful computers with a productivity of many millions of operations per second and a main memory capacity of tens of megabytes are being produced as well as various external memory storage structures, input/output devices and well-developed nomenclature for teleprocessing and data preparation.

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Recently, the following computer devices have been developed:

YeS-1027 computer (Czechoslovak Socialist Republic)with high-speed action of 200,000 operations per second, a main memory capacity of up to 2 megabytes and total I/O throughput of 2.5 megabytes per second; YeS-1036 (USSR and People's Republic of Bulgaria) with 400,000 operations per second, up to 4 megabytes and 4.6 megabytes per second; YeS-1056 computer (German Democratic Republic) with 500,000 operations per second, up to 4 megabytes and 9 megabytes per second; YeS-1066 computer (USSR) up to 12.5 million operations per second, with up to 16 megabytes and 16 megabytes per second correspondingly;

YeS-5027 storage on magnetic tape (People's Republic of Bulgaria) with automatic take up of tape, with a transfer speed of 738 kilobytes per second and with a memory density of 63/246 bytes/mm.;

YeS-5063 removable magnetic disk stores (People's Republic of Bulgaria) with a capacity of 317 megabytes, with a data transmission velocity of 1198 kilobytes/second;

YeS-1830 professional/personal 16-bit computer (Hungarian People's Republic) with a command execution time of 2-10 microseconds, and a main memory volume of 256 kilobytes;

YeS-8371.01 teleprocessor processor (Polish People's Republic) with a through-put capacity of 20 kilobytes/seconds, a channel communications transfer rate of 50-4800 bits/second;

SM-7221 alpha-numeric videoterminal (Cuba) with a screen capacity of 1920-3168 symbols;

SM-5313 flow tape drive (Socialist Republic of Bulgaria) with a data transfer speed of 160 kilobytes/second and memory density of 63 bits/mm.;

number of printing devices, input/output structures and information preparation devices.

The unity in technological and design decisions and software compatibility of the computer devices issued makes it possible to put together systems of required configuration and practically unlimited productivity. Thus, Ryad-3 YeS third stage computer devices may create powerful computing systems with prescribed high-speed action, designed for:

carrying out complex scientific and technical calculations requiring large productivity with highly precise and accurate results;

solving informational-logic problems on the basis of a particularly large data base (10 to 1000 trillion bytes);

modelling complex processes and controlling facilities in real time which require high speed processor operation and a multifaceted complex of communication devices connected to these processes;

automated design of complex items, which requires well-developed machine graphics equipment and interactive systems, optimization and diagnostic complexes, etc.

From these items also are "assembled:"

computer systems for collective use with remote access and a great number of subscribers, possessing an effective mechanism for distributing computer resources and dialogue operating modes;

computer networks of individual enterprises, branches of industry, regions, statewide and international networks ("Interset'") based on a unified design concept from the lowest to the highest level and unified computer devices.

Recently, the broad application of microprocessor technology based on innovative articles of microelectronic element base has become significant. A large range micro and mini-computers with personal/professional and personal/every day orientation have been developed and produced, using the microprocessor technology of the SM family of computers which have 8, 16 and 32 bits, high speed operating capacity up to 1,000,000 operations/seconds and a main memory of up to 2 megabytes with increased reliability.

During the course of the 36th Meeting of the CEMA Conference 10 June 1982, in Budapest, an agreement was signed on multilateral specialization and cooperation in the development and production of articles for the microelectronic element base for CEMA special equipment and particularly pure materials.

By 1984 in the participant countries approximately 650 types of large-scale and superlarge-scale integrated microcircuits, specialized for computing, were prepared. This included 4, 8, and 16 bit microprocessor large-scale integrated circuits, large-scale memory devices with a capacity of 4, 16 and 64 kilobits of various speeds, a series of logic and analog integrated circuits, large-scale integrated circuits, programmed logic matrices, single chip 8 and 16 bit microcomputers and other microelectronic articles which correspond to the best world achievements.

In order to organize their production countries are creating and manufacturing special technological equipment, constructed according to the modular principle of flexible automatic production. Its nomenclature contains approximately 150 types, some tens of which have already been matched for each other. The Intergovernmental Commission on Cooperation in Computer Technology together with the CEMA Permanent Commission for cooperation in the areas of the radiotechnological and electronics industry, in the chemical industry, in ferrous metallurgy, as well as in non-ferrous metallurgy are carrying out the development and production of especially pure materials for microelectronics. This permits a sharp reduction in their importation from capitalistic governments and creates in countries participating in the agreement an especially modern base for manufacturing them.

As a result of the decisions of the Economic Agreement which placed first the provision of high quality machines and equipment at the world technological level to key branches, we will devote special attention to the creation of the models of the YeS Ryad 4 computers and the SM third generation computers, which include many features of the fifth stage computers.

As calculations show, to completely satisfy the requirements of the economies of fraternal countries for computer technology a significant increase in the quantity of computers manufactured is necessary. For this purpose the advantageous growth of cheap, mass micro- and minicomputers must be guaranteed.

Solving these problems will make it possible to change over to a new system of information provision and, on this basis, to obtain an intensive growth in labor productivity in all branches; to use more rationally energy and raw materials resources and to reduce substantially the cost/productivity coefficient for all types of industrial and agricultural production.

For mass information provision systems of the future, the following will be characteristic:

at the lowest hierarchical level data processing will be done by small local systems and personal computers constructed from appropriate types of micro- and minicomputers, the cost of which is 10-15 times less than usual on account of using the large-scale integrated systems or superlarge-scale integrated systems. They should be equipped with a special microperipheral and well-developed software which would allow the user to interact with the computer without special mathematical or technical knowledge;

at the middle level there will be powerful computer complexes for collective use, possessing the possibility of aggregate increase in speed and precision in processing and memory capacity. A component part of these complexes are the well-developed peripheral systems, subsystems of diagnostics of user microprogramming and service in n twork modes of different automatic control systems;

at the upper level are computer complexes with new architectural-logic constructions ensuring computer capacities two to three times greater than those existing presently. They should operate as independent centers of mass service for various user and organizing systems, which unify computer devices into unified regional, state and international networks. In this respect the high degree of reliability of all the devices acquires a special significance.

Further development in computer technology will be carried out due to the sharp increase in the quality and reliability of hardware under development, creation of data processing systems based on fifth generation computers, development and introduction of personal computers for office and daily use. The expansion or production of devices using microprocessor technology, micro-electronic articles, the significant improvement of centralized service and use in the economy of hardware and software, the creation of an international computer network within the framework of project "Interset'" are also notable.

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COORDINATION OF CEMA WORK ON MICROELECTRONICS DESCRIBED

Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRANCHLENOV SEV in Russian No 1,
Jan 84, pp 15-18

[Article by YuriyMaslyukov, First Deputy Chairman of USSR Gosplan and Perma-
nent Chairman of the International Commission on the Collaboration of Social-
ist Countries in the Field of Computer Equipment: "Catalysts of Technical
Progress"]

[Text] I

Decisions of the Communist and Workers' Party Congresses of the countries of
socialist collaboration indicate that, in order to increase the economy's ef-
fectiveness, comprehensive mechanization and automation based on the wide use
of microprocessor equipment, industrial robots and electronics are of great
importance. Today they provide not only for growth in labor productivity but
also for change in labor's social conditions.

Special attention was paid also at the 36th meeting of the CEMA Session to
these priority areas of specialization and cooperation and their mutual ties
with operations in the computer-equipment field.

As experience indicates, the tasks assigned can be accomplished successfully
on the basis of the development and conduct of a coordinated technical policy,
an integrated approach to its realization, and the execution of a large number
of measures throughout the cycle of science, development, production and sales,
including questions of unification, standardization and introduction.

Chairman of the USSR Council of Ministers Comrade N. A. Tikhonov noted at the
CEMA Session that in the modern era the concentration of efforts in the main
areas of scientific and technical progress and the creation of a backlog of
accomplished work in the manufacture of modern machines that save energy, ma-
terials and labor, as well as of the means for automation that use the new-
est achievements of electronics, are matters of paramount importance.

The microelectronics-elements base (MEB) and microprocessor equipment are
piling up practically all the achievements of scientific and technical
progress, in both the organization of production and the creation of com-
pletely new production processes and the appropriate equipment, materials and
articles. Today, qualitative achievements in both science and some leading
branches of industry--metallurgy, chemicals, electrical equipment, the

electronics industry and instrumentmaking--have been occasioned to a great extent by the growing demands for materials and outfitting articles by the developers and producers of computer-equipment systems (SVT's).

The Agreement on Multilateral International Specialization and Cooperation in the Development and Production of Articles for the Microelectronics Elements Base for Computer-Equipment Systems, of Special Production Equipment and of Highly Pure Materials for Microelectronics and the General Agreement on Multilateral Collaboration in the Development and Wide Use of Microprocessor Equipment in the Economies of CEMA Member Countries, which were signed during the 36th Meeting of the CEMA Session, are aimed at realizing the tasks of the development and wide use of computer equipment, and, on that basis, of automated systems in the national economies of the participating countries.

As is known, the first agreement planned the following division of labor among the countries:

systems for automated design--the BNR [People's Republic of Bulgaria] and the USSR;

measuring and testing equipment--the MNK [Hungarian People's Republic];

optical and mechanical equipment--the GDR;

equipment for the assembly of integrated microcircuits--the PRL [Polish People's Republic];

equipment for processing semiconductor materials--the RSR [Socialist Republic of Romania];

equipment for manufacturing structures for large and superlarge integrated microcircuits (BIS's and SBIS's)--the USSR; and

equipment for research and for monitoring and measuring--the CSSR [Czechoslovak Socialist Republic] and the GDR.

Said agreement broadens the framework-type General Agreement on Multilateral Collaboration in the Field of Creating a Single Unified Base of Articles of Electronic Equipment, Special Production Equipment and Special Materials for the Production Thereof, which was signed during the 35th Meeting of the CEMA Session.

II

In accordance with the agreement, the Intergovernmental Commission on the Collaboration of Socialist Countries in the Field of Computer Equipment (MPK on VT) provides for the coordination of efforts in the area of microelectronics. This will help to reduce the worktime spent, based upon use of the newest achievements of the participating countries.

After examining at its 26th Meeting (April 1983) questions of realizing the agreement, the Commission adopted the Plan for Development of MEB Articles for Computer-Equipment Systems. It calls for the creation and the startup

of output in 1983-1985 of 125 types of BIS's and SBIS's of varying degrees of functional complexity. The Unified List of Integrated Microcircuits Used in Computer-Equipment Systems, in accordance with which more than 500 types of MEB articles are manufactured for them in participating countries, was approved. It was recommended that the national units of MPK on VT include the indicated list in the export-import program for the appropriate foreign-trade organizations.

The necessity for further optimizing the products mix of MEB and SVT items was pointed out as the most immediate task. This will enable the effectiveness of the production thereof in these countries to be raised and interchangeability, reparability and reliability to be provided for.

I would like to dwell especially on the link-up of work in the MEB and SVT fields. It is achieved through a system for the computer-aided (automated) design of articles for microelectronics and for the logic-architecture portion of computer installtions.

Let us begin with a typical system for computer-aided design. It contains workplaces for the designers, based upon microcomputers and minicomputers, which are joined by a large (high-powered) computer with a data bank. This provides for the development of BIS's and SBIS's (especially of microprocessor and matrixer integrated circuits) and an interface with the design for modules and standard replacement elements. Such a system is already being used today to design items produced in countries that are participating in the agreement.

At present the Council on the Microelectronics-Elements Base for MPK on VT is paying paramount attention to increasing the output of promising production equipment, to reducing the work's labor intensiveness, and to introducing new production processes and methods which will provide for a high technical level and for the reliability of the MEB. In order to solve these tasks, which are comprehensive in nature, leading scientific and production collectives of all countries participating in the agreement have been called in.

With a view to raising work effectiveness in the area of creating articles for the microelectronics-elements base, the countries' specialists have selected and coordinated standard progressive production processes for making BIS's and SBIS's and a products list of promising models of equipment. The modular principle, based upon general technical requirements, is used for creating them.

Modul'-1 is a complex for standard logic (low-powered and high-speed) and analogous microcircuits of a mass-produced series. It contains 91 types of hardware, 64 of which are now being exported. The specifications have been coordinated for the remainder, and the dates for start of shipments have been set.

Modul'-2 is a complex for microprocessor BIS's and SBIS's of storage devices. There are 109 units of hardware in it, 37 of which are already being shipped.

Modul'-3 is a complex for superhigh-speed (SSIS) and superlarge (SBIS) inte-
grated microcircuits, including matrixer BIS's of various types. It
includes 104 types of hardware, 30 of which are being shipped reciprocally.

The fact that portions of these complexes are controlled by automated systems
based upon microcomputers and minicomputers and that complex units for spe-
cial production equipment are controlled by automated systems based u on
built-in microprocessors is characteristic for all these complexes. Such
units include those which are intended for epitaxial build-up, diffusion
systems, systems for ion doping, electron-beam installations, superposition
devices and projection-exposure devices, systems for measuring the parameters
of BIS's, SBIS's and SSIS's, and so on.

After the agreement was signed, high-purity materials for microelectronics
were further developed and produced. The products list thereof rose from 29
specific items to 101, mutual shipments of which have already been started
for 51.

Inasmuch as the agreement is of a multiplan nature, especially in the area
of high-purity materials, it can be realized successfully only with the close
collaboration of the MPK on VT with CEMA organs and organizations, primarily
with the CEMA Standing Commissions on Collaboration in the Field of Radio-
Engineering and the Electronics Industry, in the Field of Nonferrous
Metallurgy, and in the Field of the Chemical Industry; the International Eco-
nomics Organization, Interkhim; and so on.

The great complexity of the new generation of special production equipment
for BIS's and SBIS's and the necessity for high-purity materials requires in-
creased capital investment in the industry, particularly for the performance
of scientific research and experimental design. Research in the field of
solid-state physics is now becoming of great importance.

With a view to speeding up the development and conquest of the series produc-
tion of a promising products mix of microprocessor sets of BIS's, memory-
type BIS's and SBIS's, a further joining of the efforts of all the participat-
ing countries is needed. They should be aimed at developing new methods for
design and more improved production processes and at creating precision
equipment and highly pure materials. In this case, close coordination and
the mutual ties of scientific research and experimental design play an in-
creasing role, both in microelectronics and in computer equipment.

In order to provide for a single technical policy for creating computer-
equipment systems and the newest MEB articles, special production equipment,
and highly pure materials, which will serve the purpose of satisfying com-
pletely the requirements of participating countries through their own produc-
tion facilities and mutual shipments, specialization should be further
intensified as quickly as possible, while calling for, in so doing, an in-
crease in capital investment in the appropriate branches of the national
economy.

III

I would like to dwell especially on realization of the master agreement for
microprocessor technology. Organizational questions are today being given

first priority. This refers to the fact that the development and manufacture of this equipment and of the basic software will be coordinated within the framework of the Intergovernmental Commission on VT [Computer Equipment], and that its use will be coordinated within the framework of the CEMA Committee on Scientific and Technical Collaboration.

In order to carry out the program of collaboration within the commission's framework, plans for developing computer-equipment systems have been prepared. They call for the wide use there of microprocessors, based upon the newest articles of the microelectronics-elements base and the newest software.

A large range of microcomputers and minicomputers is already being produced. These include the SM 1300 (SM 50/50), SM 1800 (SM 50/40-1), SM 1403 (SM 52/11), SM 1404 (SM 51/13), and others. The following have also been given their "start in life": the microprogrammable processor SM 1634 (SM 50/60-1) and peripheral equipment--floppy magnetic disc storages SM 5603, SM 5606 and SM 5610, printers SM 6302, SM 6306, SM 6309 and SM 7108, alphanumerical displays SM 7206 and SM 7401, graphics displays SM 7300 and SM 7301, modems SM 8105, SM 8107 and SM 8108, and so on.

Today it is planned to take still another step forward. The development and production of a new large range of microcomputers and minicomputers, with the use of microprocessor equipment of the SM family of components of the third stage, are being planned. They will have 8, 16 and 32 bits. Speed will be 250,000 to 4 million operations per second. Main memory will be up to 64-1,024 kilobytes. Further improvement of the peripheral equipment also is called for.

Microprocessors are being used especially widely in technical computer-equipment systems, primarily for the control of displays, input-output devices, devices for information processing and data preparation, external storage devices, printers, and so on.

The burgeoning development of electronics is leading to important technical and social changes that are associated with the nature of man's relationship to the computer. With increase of the computer's intellectual capabilities, the potential for overreliance on its solution of many tasks for controlling facilities, for processing information, and so on increases.

It is now possible to single out the following main fields for the wide use of microcomputers and minicomputers based upon microprocessor technology, the most important requirements of which meet most closely the requirements of world practice and permit the greatest economic and social benefits to be obtained. These are, primarily, automated:

systems for controlling industrial processes (in chemicals, metallurgy, the oil and gas industry, and so on);

systems for controlling operating equipment, machine tools, vehicles, power installations, electric drives, hydraulic-engineering facilities and industrial robots;

systems for controlling power and line-dispersed facilities and transport-flow systems (high-voltage power lines, gas pipelines, and so on);

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systems for organizational control, current planning, and control-center facilities, including systems for the workplaces of engineers, technicians and white-collar workers;

industrial, scientific and medical-measurement monitoring and diagnostic devices and instruments;

apparatus and means of communication for the processing and transmission of information;

devices for a set of transport vehicles and other machines, equipment and systems and for the control thereof; and

systems, devices and instruments for large-scale private use and for domestic purposes.

A unified microelectronics-elements base, unified interfaces and a command system and software that are compatible with the SM types of computers that are being produced and with existing peripheral equipment are being used in the microcomputers and minicomputers that are being created.

With a view to providing for an interface of microcomputers and minicomputers, and also of peripheral equipment, with control and regulating facilities, work in the area of analog-to-digital and digital-to-analog signal converters and communications devices must be developed.

Deeper specialization of countries on the basis of a generalization of the whole backlog of theoretical and practical work that has been accomplished on automated systems for control and information processing and on the control of machinery and machine tools, electric drives and industrial robots, communications systems, and other facilities is required for the wide introduction of such microcomputers and minicomputers. Promising routes for developing unified designs and an interface based upon the concept of the SM computer's third stage should be developed, and more precise contacts with related branches of industry should be established. In so doing, it is desirable to allocate specialized production facilities in the countries for the manufacture of microprocessors for computer-equipment systems and for other branches of industry.

The development of work on creating a Unified System for Switching-Equipment Systems and Systems for Numerical-Program Control of Machine Tools and Industrial Robots, which is performed within the framework of the appropriate multilateral and bilateral agreements, also is linked with further improvement of the microelectronics-elements base and of microcomputers and minicomputers.

Expansion and intensification of the fraternal countries' collaboration in the area of microelectronics and microprocessor equipment will enable the quality of the newest MEB and SVT articles to be raised greatly in a relatively short time and the output thereof to be increased. And this, in turn, will lead to a rise in the technical level and productivity of labor in many other branches of the national economies of the CEMA member countries. The commodity turnover of microelectronics articles, special production equipment, high-purity materials and microprocessor-based computer-equipment systems, which increases from year to year, will play an important role here.

This is one more testimony to the wide opportunities for CEMA member countries to raise the technical level of production and to convert production to the intensive path of development.

HUNGARY CREATES MICROELECTRONICS ENTERPRISE

Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRANCHLENOV SEV in Russian No 1,
Jan 84, pp 54-56

[Article by Ferenc Banjai, technical director of the MNK's Microelectronics
Enterprise: "A New Step in the Development of Hungarian Microelectronics"]

[Text] Microelectronics is right now the most dynamically developing area of
industry. There is no longer any sphere of activity where its advantages have
not been shown.   One of the indicators of a country's level of development
today is the broadness of use of microelectronics elements in industry and
agriculture. In recognizing its enormous role, the governments of many coun-
tries are devoting substantial resources to the creation of a modern micro-
electronics-elements base. The MNK [Hungarian People's Republic] decided in
December 1981 to combine scientific-research facilities and industrial enter-
prises and to create on the basis thereof, starting in January 1982, the MNK
Microelectronics Enterprise.

The enterprise is operating in accordance with the State Program for Develop-
ing the Production of Components and Parts for Electronics and with the State
Midterm Plan for Scientific-Research and Technical Development During the
Current Five-Year Plan.

Creation of the enterprise should help to resolve the following basic problems:

the production of elements and components of microelectronics with modern tech-
nical and economic parameters, the provisioning of these items primarily to
domestic instrumentmaking, an expansion of the variety of electronics produc-
tion equipment, and a rise in its competitiveness;

an expansion, because of the limited nature of the MNK's internal market, of
the export commodity stock, that is, pro .ction in the appropriate quantity
and required quality of electronic elr   .ts for exchange purposes, using to
the maximum, in so doing, the advanta   of the international socialist divi-
sion of labor;

an increase in the net current income of the enterprise and of the whole na-
tional economy through a great reduction of imports from capitalist countries;

participation in collaboration within the CEMA framework, which will help
to eliminate the consequences of the discriminatory restrictions observed on

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the world market and will enable our country and the other fraternal coun-
tries to be supplied with the materials and elements necessary for producing
electronic equipment;

wide use by the enterprise of the potential of microelectronics for producing
modern equipment, instruments and machinery at the high level that is suitable
for export; and

the development and wider use of custom-made large integrated circuits (BIS's).

In accordance with the government program, the training of specialists was
entrusted to the enterprise with a view to making wider and more effective
use of highly complex integrated microcircuits and to forming at customer en-
terprises appropriate groups of designers and specialists who will work with
these microcircuits.

The main sphere of the Microelectronics Enterprise's activity will be the pro-
duction of monolithic integrated microcircuits. Beginning in 1985, it will
start the series production of integrated microcircuits and digital instru-
ments for MOP metal oxide semiconductor and bipolar technologies: from design
to final measurement. In so doing, major attention will be paid to producing
custom BIS's, the simplified versions of which are matrix BIS's.

Another important field of the Microelectronics Enterprise's activity is the
development and series production of hybrid integrated microcircuits, which
have been used widely in consumer goods and especially in occupational
electronics.

Moreover, our enterprise is developing and producing small series of computer-
controlled measuring systems which are intended for measuring microelectronics
systems of high complexity, which even today is a task of paramount import-
ance. The complexity of an integrated circuit can be as great as that of a
computer, for example in some microprocessors. They can be measured only
by high-speed systems.

Jointly with Soviet specialists, our enterprise has developed large measuring
systems which operate on 10-25 MHz frequencies and have become well-known
under the IKOMAT designation. Already today about 60 automated IKOMAT-110
measuring devices are at work at various semiconductor-equipment plants in
the USSR and the GDR. In 1982 the enterprise manufactured and shipped to the
USSR two new types: the IKOMAT-115 and IKOMAT-200. This equipment will
greatly facilitate monitoring the output produced at plants that make inte-
grated circuits, and it tells the customers about the quality of the items
produced.

A rather large amount of work is being done at the enterprise to create and
produce equipment for manufacturing integrated circuits. Many socialist
countries are using the electron-beam evaporators, magnetron deposition sour-
ces, furnaces for baking and drying, installations for masked furnaces,
optical reduction chambers, and so on, that we have produced. The creation
of this equipment is a major contribution to the development of microelec-
tronics in socialist countries.

Broad international ties are characteristic of the enterprise. A number of responsible workers are members of the 6th and 8th Sections of the Standing CEMA Commission on Collaboration in the Field of the Radio-Engineering and Electronics industry and of two sections of the Council on the Microelectronics-Elements Base of the Intergovernmental Commission on the Collaboration of Socialist Countries in the Field of Computer Equipment.

The enterprise's bilateral ties are reflected in long-term agreements on scientific and technical collaboration with almost all the socialist countries. Moreover, we maintain direct contacts with almost 20 enterprises of these countries; these contacts extend to multilateral and bilateral scientific and technical collaboration, embracing specialization and standardization, as well as to trade activity.

Microelectronics is a relatively new and dynamically developing branch of science and production. Broad collaboration is necessitated by the rapid exchange of new results, organization of the production of optimal series of various types of products, and the effective use of expensive equipment. This can be achieved only through specialization.

Hungary's equipment manufacturers use annually 6,000-7,000 types of integrated circuits and semiconductors. The demand for each of them varies from several thousand to several hundreds of thousands of units. Not one of the enterprises can produce such an amount of diverse types. This is why close collaboration among the fraternal countries in this field, which will enable the variety of products to be increased and the requirement for electronic-engineering articles to be fully satisfied, is necessary. Moreover, in order to produce integrated circuits, expensive production equipment with high technical parameters is needed. In many cases its development and production by a single country is impossible. The role of collaboration within the CEMA framework in this area, both now and in the future, consists in agreed-upon areas of scientific research and development, on the one hand, and, on the other, in use of the advantages of international collaboration and in the development of proposals for specialization in the production of this equipment.

The work of Section 1 of the Council on the Microelectronics Elements-Base and of Section 6 of the CEMA Standing Commission on Collaboration in the Field of the Radio-Engineering and Electronics Industry has yielded good results. Specialization has been set for production of the major portion of this equipment. In the future, it should be produced more effectively so CEMA member countries will reach the world level as quickly as possible.

Our enterprise would like to participate more widely in international collaboration in the production of custom BIS's and the output of automated measuring instruments.

Custom BIS's are a new field in the development of microelectronics elements. Previously, electronic systems were made up of integrated circuits, which were entered in a catalog in accordance with definite functions. The designers' main task consisted in the rational matching of the integrated microsystems selected from catalogs to the required functions and tasks and in the creation of equipment based thereon.

Our strategy in developing semiconductor microcircuits reflects the world trend, in accordance with which the functions of electronic equipment should be designed and specified right in the elements themselves. Therefore, the designers of integrated microcircuits based upon silicon, in order to achieve the prescribed goals effectively, should visualize precisely the operation of the equipment in which the integrated microcircuits are to be incorporated.

In international collaboration in the output of automated measuring equipment, we would also like to specialize in the design and production of the IKOMAT series. Jointly with GDR and USSR specialists, the MNK has already started to develop new measuring systems. The most immediate task is to manufacture the IKOMAT-125 type measuring system, which operates on frequencies of 20-25 MHz.

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The collaboration of CEMA member-nation specialists is having a fruitful effect on scientific-research activity in each fraternal country and is helping to create effective equipment. The MNK Microelectronics Enterprise is a graphic example of participation in multilateral and bilateral collaboration on the basis of mutual advantage, creating, on the one hand, favorable conditions for the enterprise's development, and, on the other, helping to satisfy better the requirements of all CEMA member nations.

VARIOUS COMPUTER APPLICATIONS CITED, HOME COMPUTER MENTIONED

Moscow MOSKOVSKAYA PRAVDA in Russian No 119 (19839) 23 May 85 p 2

[Annotation] A directive of the April (1985) CPSU Central Committee Plenum concerning the need to convert to fundamentally new high-performance hardware systems of the latest generation poses for scientists and industry a number of crucial and weighty problems. One of them is to use electronics more widely and effectively, to develop and produce various types of computers that are capable of greatly improving production control, while shortening the time needed for research and development. Materials in this issue's "Science-Technology-Progress" section are devoted to aspects of this important task.

[Article by N. Aksenov, "What a Computer Can Do"]

[Text]

Saves Energy

A minicomputer has come to the aid of the power engineers at the automobile factory imeni Leninskiy komsomol. It is now their primary advisor for selecting the operating modes of a variety of equipment that maintains the appropriate microclimate in the shops of the factory. With the help of scientists from the Scientific Research Institute for Structural Physics, they studied scores of factors influencing the temperature and humidity in the enterprise's main building. The building's "thermal portrait" was created. They also analyzed the special features of the various equipment affecting the microclimate, from ovens and conveyors to ventilators and ducting. A computer program was generated, based on the resulting data. The computer new tells the power engineers when and how many ventilation devices to use and in which mode the heating system should be. The computer warns of needless heat loss and emergency situations. This system saves more than four tons of standard fuel, conserving almost one-sixth of the thermal energy for the factory's main building.

Does Research

Truly unique experiments in the field of protein molecule structure are being conducted by scientists at the Institute of Crystalography imeni Shubnikov of the USSR Academy of Sciences. The coordinates of thousands of atoms are determined from maps showing electron distribution density. The actual object of this research is protein crystals. Their x-ray photographs also help to

produce molecule "maps". Every x-ray photograph contains a great deal of information. A computer helps scientists process and analyze this information. It would be practically impossible without the computer to conduct a structural analysis of the protein, unlock the "secrets" of its activity and apply the resulting data.

Stores Information

The creation of a large-scale "information bank" has been started at Gosstandart USSR. This "electronic data warehouse" will help the developers of new technology, machines and equipment accurately select materials for their projects. Here, the user can receive information not only about products already in batch production but also about materials recently developed by scientists. The computer will also provide information on various types of fuel, catalysts and other substances. According to specialists, the creation of this "information bank" will noticeably improve the efforts of designers and technicians.

Runs the Household

Production has started of one of the first domestic household computer systems, the Elektronika BK-0010. This compact unit includes a microcomputer, computational module and power supply. The home computer is capable of storing great quantities of information: from telephone numbers to school assignments to information on various branches of science. The creators of this new item have made it possible to actively use the system for educational purposes: for teaching school children as well as for improving the skills of adults.

SERVING THE CITY: FIRST IN THE WORLD

[Unattributed article under Science, Technology, Progress rubric]

[Text] The development of the second stage of the "Moscow" ASU [Automated Management System] is being completed. This unique complex of management systems is without peer in the world today in terms of its scale and complexity.

Specialists and everyone else helped by computers in speeding up work and lowering labor, fuel and other resource costs are familiar with many of the ASU that comprise the "Moscow" system: "Khlebprom", "Mosavtotrans" and others. A number of systems are already in operation at the branch, rayon, and municipal levels. In its first stages of development, this automated complex will combine the resources and electronic potential of more than 500 various ASU that are now being developed or that have already come on line in various municipal departments. At another level, the control of industrial processes, several hundred more systems will be set up. Scores of branch, interbranch and rayon ASU will also be included at this level. As the experience of operating the "Moscow" complex first stage has shown, a variegated integrated system makes it possible to enhance the operations of industry, transport, domestic services and other branches of the capital's economy.

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CORRESPONDENCE WITH OUR READERS: CALL A "LUCH" FOR HELP

[Unattributed article under Science, Technology, Progress rubric]

[Text] In our shop, we often have to cut intricately designed parts out of sheet metal. This is complicated and heavy work. There are machines to lighten our load, but they don't solve our problems: our work remains very labor-intensive. What can scientists and designers do about this?

                                            A. Kolotov, pattern maker, fifth-class

We asked I. A. Krotov, doctor of technical sciences, to answer this question:

"The multiplicity of operations to be found in metal-working has long been the subject of the creative attention of the makers of the new industrial technology. Whether the subject is a way of conserving steel, the rolling process in manufacturing, a way to make the work of machine operators easier, or a more precise way of selecting technology, our attention is focused on the latest equipment based on laser, ultrasonic, and of course, electronic and microprocessor technology.

But to answer the question of A. Kolotov, there is a project that has been completed by specialists at the All-Union Scientific Research and Design Institute for Autogenous Machine-Building. They have developed and successfully tested a prototype of a new device.

It lets a laser beam cut the metal. The laser beam is controlled by a computerized device. This device precisely guides the beam along a given path, "enscribing" complex figures on the metal. This eliminates manual labor. Its high speed, accuracy of calculation, and the optimal use of the metal enables this new device to make a significant contribution to industry, "Luch" [Ray], as this new device is called, has been successfully tried out at the automobile factory imeni Likhachev. It is now being readied for batch production at an autogenous machine-building factory."

12713
CSO: 1863/332

HARDWARE

A DIGITAL TELEVISION VIDEO SYSTEM

BELOMESTNYKH, V. A., KASPEROVICH, A. N., POPOV, Yu. A., SUTYAGIN, V. G.,
SHALAGINOV, Yu. V. and YUNOSHEV, V. P., Novosibirsk

[Abstract] A description is presented of a specialized digital real time video
system developed at the Institute of Automation and Electrometry, Siberian
Division, USSR Academy of Sciences. The system is similar in its functional
characteristics to the SYSTEM-100 manufactured by I^2S. The system includes a
television camera, high speed ADC, dot processor with nonlinear intensity con-
verter, digital memory device, DAC and television monitor. It also includes
a digital, Elektronika-60-based multiplexer to implement the necessary connec-
tions between parts of the system, an apparatus for sequential connection to a
central computer as well as a vector operation processor. The system is con-
trolled during input, storage and processing of data and visualization of
results by an 'Elektronika-60M' computer. A photograph of the system is pre-
sented. The system is presently in experimental use, performing experiments on
accumulation and differentiation of objects during astrophysical studies,
improvement of image sharpness and other problems. Figures 3; references
4 Russian.
[147-6508]

ESTIMATE OF FUNCTIONAL CAPABILITIES OF PROGRAMMABLE LOGIC MATRICES

ARTYUKHOV, V. L., SHALYTO, A. A. and KUZNETSOVA, O. S.

[Abstract] Many works have discussed methods of rational utilization of pro-
grammable logic matrices. This article discusses the functional capabilities of
these PLM. The characteristics of a PLM with only direct inputs and outputs are
estimated as it implements a normal formula of h characters and the disjunctive
normal form obtained from the formula by opening of brackets. Implementation of
the bracket formula in the PLM is achieved by its representation as a system of

(c/2)+ 1 DNF which are subformulas, where c is the number of brackets in the
formula. After this, each DNF is implemented at the corresponding output, while
each of these, except for the last, where the entire formula as a whole is
implemented, is connected to the corresponding input. It is found that for any
h the value of k assuring the maximum number of terms is constant and equal to
e, whereas the value of k guaranteeing the maximum number of characters in the
DNF depends on the number of characters h in the initial formula. Equations are
derived for estimation of the number of inputs, terms and outputs required for
implementation of arbitrary bracket formulas and the corresponding disjunctive
normal forms. A method is suggested for repeated utilization of preprogrammed
PLM which can also be used for the construction of programmable read-only memory
devices (PROM). References 5 Russian.
[277-6508]

SELF-TESTING AND REDUNDANCY IN VERY LARGE MEMORY MICROCIRCUITS

BEREZIN, A. S., ONISHCHENKO, Ye. M. and SUSHKO, S. V., Moscow Engineering-
Physics Institute

[Abstract] Simplification of testing of VLSI RAM chips can be achieved by
partially transferring the functions of testing to the chips themselves, i.e.,
self-testing. This allows simultaneous testing of all chips on a board. A
VLSI memory chip with self-testing and on-chip redundancy is analyzed. A
self-test is performed each time power is turned on and any defective locations
are recorded in special additional memory locations on the chip. A test of
length 4 N, where N is the number of locations in the accumulator, is sufficient
to determine failures of entire rows or columns, as well as locations which
always contain a one or zero regardless of what has been recorded in them.
Even a simple test of this type is quite effective. The use of tests revealing
other types of errors makes power-on testing longer, reducing available machine
time. Figure 1, references 11: 4 Russian, 7 Western.
[267-6508]

DESIGN OF MEMORY TESTS ON THE BASIS OF ANALYSIS OF SEQUENCES OF FUNCTIONAL
OPERATORS

GRINSHTEYN, A. V. and NOVIK, G. Kh.

[Abstract] A method involving analysis of sequences of functional operators is
used to derive a test which detects any combination of the subclass of defects

in RAM resulting from the mutual influence of arbitrary pairs of memory loca-
tions. The method is used to produce a minimal march requiring 30N operations.
The method itself and the properties and types of sequences of functional opera-
tors can be used for more complex memory defect models as well. The properties
of the sequences of functional operators established allow estimation of the
completeness of the testing achieved by existing tests. Figures 2;
references 6: 3 Russian, 3 Western.
[267-6508]

EXPERIMENTAL CHECK OF RELIABILITY OF MODELING OF LATENT IMAGES IN AN
ELECTRONORESIST

DERKACH, V. P., KORSINSKIY, V. M., STARIKOVA, L. V. and KURBATSKAYA, N. P.,
Institute of Cybernetics, Ukrainian Academy of Sciences

[Abstract] The purpose of this work is to provide an experimental check and
confirmation of the adequacy of theoretical statements and programs describing
the processes actually occurring in an electronoresist. The calculated char-
acteristics of a latent image are compared with the actual image produced in
the electronoresist after development. A very thin resist layer and quasi-
threshold development conditions are used to minimize development-induced dis-
tortion. A test figure was exposed on a ZRM-12 cathode ray system with an
accelerating voltage of 30 kV and electron beam diameter less than 0.05 μm.
The images produced after quasithreshold development were examined and photo-
graphed on an optical microscope. Considering the errors observed, the great
variety of elements in the test figure and the rather large range of variation
of radiation densities, the agreement of calculated and experimental results
must be considered good, confirming the correctness of the theoretical assump-
tions made and the capability of the programs used in the computation, which
can be reliably used in the investigation of latent images formed by a beam in
a layer of resist to allow timely adjustment of exposed topologies. Figures 5;
references 14: 8 Russian, 6 Western.
[296-6508]

NOISE CHARACTERISTICS OF STROBOSCOPIC CONVERTERS BASED ON GALLIUM ARSENIDE INTEGRATED MICROCIRCUITS

STAROSEL'SKIY, V. I.

[Abstract] The characteristics of strobe converters can be improved by making the input device as a gallium-arsenide-based integrated microcircuit, which allows some decrease in converter internal noise, by the use of a four-diode bridge circuit microwave band mixer, by the use of special accumulating condenser discharge circuits, by implementation of full accumulating condenser charging in the microwave band, by selection of the dimensions of microcircuit components, and by the achievement of extremely low leakage currents. An integrated microcircuit for the input device of a strobe converter is described. Sources and mechanisms of internal noise in the converter are analyzed and possibilities for minimizing the noise by optimal selection of amplifier-integrater bandwidth are discussed. Flicker noise in the output repeater is the major source of noise and can be decreased by full charging of the accumulating condenser during the strobe cycle, optimizing the bandwidth of the output amplifier and optimizing the topology of the field-effect transistor. Decreasing the integration time of the expanded pulse with the output amplifier can practically neutralize breakup and flicker noise of closed mixer diodes. Figures 3; references 5 Russian.
[267-6508]

AUTOMATED MOSSBAUER SPECTROMETER INTERFACE

YEVDOKIMOV, V. A., KONONOV, Yu. G., LOBKO, A. S. and FEDOROV, A. A.,
Belorussian State University, Minsk

[Abstract] An interface is described which is designed to transmit spectro-metric information directly into RAM of an Elektronika-60M computer for subsequent processing. Asynchronous data transfer is used to avoid unnecessary complication of the interface hardware. The interface allows access to three registers to allow information input to machine memory and one register for output. A block diagram of the interface is presented. The interface is con-trolled by a program consisting of six machine instructions capable of executing in 35 microseconds, which determines the maximum speed of the device. Practical experience with the interface has shown it to be reliable, simple to adjust and convenient to use.
[253-6508]

SIGNATURE FUNCTIONAL TESTING OF LSI RAM WITH LOGARITHMIC TESTS

GRINSHTEYN, A. V. and NOVIK, G. Kh.

[Abstract] Logarithmic procedures for which $\theta \simeq N \log_2 N$ represent a reasonable compromise between linear and exponential memory test procedures. Their duration is not as great as that of exponential procedures, while test completeness is better than that of linear procedures. A study is made of the problem of implementation of two tests in which a linear procedure of running through addresses is repeated $\log_2 N$ times, each time changing the sequence of addresses and/or data using the universal apparatus of signature functional testing. The two tests used are the march test with binary-increasing address step, repeated K times, and checkerboard test with binary increasing information step. The reliability of signature functional testing of LSI memory units by this test is 100% for constant control circuit defects. Figures 6; references 9: 5 Russian, 4 Western.
[267-6508]

SOFTWARE

YeS COMPUTER PROGRAMMING SYSTEMS (A REVIEW)

TSAGEL'SKIY, V. I.

[Abstract] At present, the YeS computer operating systems OS-4.1 and DOS-2.2
are being replaced by the new operating systems OS-6 and DOS-3. This article
first describes programming systems in OS-4 and DOS-2, supporting PL/1, FORTRAN,
COBOL, ALGOL-60, RPG and Assembler. All of the programming systems except for
the Russian version of standard COBOL are included in the operating systems.
Changes to the programming environments required by the time-sharing implementa-
tion of OS-6 are briefly described. Optimizing and debugging translators for
PL/1 have been added; FORTRAN features a new expanded optimizing translator and
support of translation and debugging in time-sharing mode; new capabilities have
been added to RPG-2 significantly expanding the area of application of the
language, making it more flexible and powerful for the solution of many data
processing problems; Assembler features expanded support for new hardware and
the new operating systems. ALGOL-68 and PASCAL translators have also been added.
DOS-3, designed for use in midrange models of YeS computers with virtual memory,
supports batch processing, remote processing and database management. Trans-
lators are provided for FORTRAN, PL/1, COBOL, RPG-2, Assembler, PL/S, SYSTRAN
and SIMSCRIPT. An optimizing Pl/1 translator and PASCAL translator are also
planned. References 11 Russian.
[233-6508]

A NEW GENERATION OF ASPID INFORMATION RETRIEVAL SYSTEMS

[Editorial Report] Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian
No 2, March-April 1985 carries on pages 126.124 a 1,400 word article entitled
"A New Generation of ASPID Information Retrieval Systems" by G.K. Stolyarov,
R.B. Grigyanets and K.P. Kvachuk. The article gives a description and
applications for new releases of the ASPID information management systems.

ASPID (Automated Keyword Information Retrieval System) is the Soviets'
continually developing family of information management software. It
operates on large-scale, mini, and micro computers and is the largest
system link for processing scientific technical, design, and organizational
management information. Two new members of the ASPID family, ASPID-5/YeS
and ASPID-7/SM, address the need for local and locally-distributed problem
oriented information systems. Both systems will be put into operation the
first quarter of 1985.

The article states that research at the laboratory for software systems
at the Institute of Mathematics Academy of Sciences of the Belorussian SSR
(AN BSSR) was completed in June 1984 for two new interactive document
data retrieval systems, ASPID-5/YeS which runs on ES computers and ASPID-7/SM
which runs on SM computers. The systems were developed under the auspices
of the GKNT SSSR (State Committee for Science and Technology) which
emphasized the high technical level of this development. The article
reports that preparations are being made to transfer the new systemr to the
Republic Collection for Algorithms and Programs (RFAP) BSSR, which will
begin delivery the first quarter of 1985 to various organizations.

According to the article, ASPID-5/YeS was designed to create interactive
document information retrieval systems on the ES computers and utilizes
the newest domestic and foreign achievements in information system software.
The system provides input, data base formatting, integrated storage, and
keyword search and retrieval of free-form text as well as highly structured
information. The following are a number of the system's features listed
in the article:

--interactive processing, information input and correction;
--creation and maintenance of a generalized thesaurus (knowledge base)
and a document information data base;
--keyword-characteristic search of documents and facts via queries and
earlier devised dialog scenarios;

--post-processing of retrieved information, report generation, and printing;
--local and remote multiple access to data bases via video display
terminals YeS 7906, YeS 7920 and user station YeS8564 (AP-64);
--linking with other systems via conversion of external data bases in a
communicative format (GKF) as well as magnetic tape information exchange
with the ASPID-7/SM and ASPID-3 systems;
--efficient compact storage and rapid information search on any of the
data base elements;
--means for constructing a secondary inverted index from any data base
element with a separate lexicon checked by the thesaurus;
--data base access by nonprocedural high level languages and by menus
designed according to the users' problem classifications;
--various means of manipulating, searching, and expanding the thesaurus;
--capability for attaching user programs in assembler and high level
languages (PL-1, COBOL, FORTRAN) for request preprocessing and for search
result postprocessing;
--a flexible and efficient systems testing method at a terminal;
--minimal demands on hardware and maintenance personnel, ease of
installation and consumer use.

ASPID-5/YeS can function as a package or in interactive modes on minimal
configurations of the ES machines controlled by the YeS operating system,
version 6.1 or higher. The package requires 100K and the interactive
subsystem 180K of main memory.

The article continues with a description of ASPID-7/SM, a new system
designed for wide application on mini and micro computers in the national
economy and for typical problem oriented software for small-scale computers.
The system can be used on disk configurations of bus architecture SM
machines (SM-1420, SM-4, Sm-1300) and is compatible with their mini and
micro models controlled by the OS RV (Real Time Operating System).
Document structures, the primary data base information units, are standardized
with the ASPID-5/YeS system and allow adaptation to the users' problems.
The documents can have various sizes and compexity from simple free-form
text to complex four level data structures with indices linking documents.
The following ASPID-7/SM features are listed in the article:

--data base management including data formatting, document creation and
update;
--on-line, interactive consultation in various data base components
(dictionaries, diagrams, thesaurus, documents) for specifying search
terms which reflect the users' needs;
--menu interface oriented to the non-programmer user;
--keyword retrieval according to Boolean search combinations.

Search terms can be document numbers, keywords, designators of assigned
data elements (up to 120 bytes), and results of previous queries. The
ASPID-7/SM file processor is a superstructure above the OS RV file system
providing multivolume processing that permits data base support of the
maximum volume that can be reached on contemporary mini computer configura-
tions. In order to minimize retrieval time, an intrasystem index structure

of files including files derived from secondary indices according to the values of seven data elements is used. The main files (documents, thesaurus, schemata) have uniform logical and physical structures that ensure unification of the majority of systems' programs and procedures as well as providing specific advantages while learning and using the system.

In addition to ASPID-7/SM and ASPID-5/YeS the article notes other members of the ASPID family currently being used in various branches of the national economy:

--ASPID-3/OS and ASPID-3/DOS--package programs for creating information retrieval systems on YeS computers;
--SPIN--specialized programs supplemental to ASPID-3/OS for converting, autoindexing, and postprocessing patent information;
--"Patent"--system for selective and retrospective processing of International Center of Patent Documentation (INPADOK) bibliographic data bases;
--SORT-7/SM--sorting subsystem for the SM-4.

ASPID-3/OS is an extension of ASPID-3/DOS and provides additional means for local and remote interactive search and retrieval, rapid data base update, and fragmentary thesaurus printing. The programs for ASPID-3 are written in assembler and PL-1. They require 56k to 200 k memory for operation.

SORT-7/SM sorting subsystem was developed in conjunction with ASPID-7/SM and allows for independent application. It ensures efficient sorting of binary or alphabetical files housed in main memory or in external media tailored to specific record characteristics (variable or fixed lengths) and sorting keys. SORT-7/SM can be used in applied systems as a subprogram requiring 5.2k or autonomously in a problem mode with an interactive interface in the OS RV environment requiring a 9k work division.

The journal claims that over 200 organizations in 65 cities of the country are successfully using the ASPID software family to create information retrieval systems. In order to enhance processing efficiency and convenience, expand capabilities, utilize new techniques and software in conjunction with national and international systems, the Institute of Mathematics of the Academy of Sciences BSSR in cooperation with other organizations is conducting research and development on:

--new versions of the ASPID-5/YeS, ASPID-7/SM, and "Patent";
--ASPID-9/MK--an interactive documental data information system for the Elektronika NTs-80 micro;
--convertors and systems for programming convertors from communicative formats (OF-8, KEOF, GKT) into ASPID formats;
--locally distributed ASPID systems;
--software for processing hybrid textual-audio-visual data.

CSO: 1863/331

OPTIMIZATION OF DISTRIBUTION OF OS YeS OPERATING SYSTEM DATA AMONG DIRECT ACCESS DEVICES

NAZAROV, S. V. and BARSUKOV, A. G.

[Abstract] The task of optimization of the placement of data sets or files among direct access memory devices to optimize operating system performance is analyzed. Practical implementation of the solution is reduced to determination of the set of files corresponding to points on a graph and determination of the frequency of transitions among them by means of universal tracing facilities for data analysis programs. The authors have developed two independent program monitors called DISK and LINK to produce this analysis, since the facility provided in OS YeS is insufficient and other analysis programs consume large quantities of computer resources, slowing operation of the computer by up to 40%. The operation of DISK and LINK is described. The algorithm and monitors developed were used to optimize the placement of files on a YeS 1033 computer, making access to the devices much more uniform and speeding up computer operation by 12%. References 7 Russian.
[269-6508]

PROGRAM DEBUGGING SYSTEM FOR MICROPROCESSOR DEVICES

GOLUSHKO, V. V., DUNAYEV, V. S. and KAZAKOVA, Ye. V.

[Abstract] A debugging system is described which can be used to debug programs or microprograms and hardware for real-time microprocessor systems. The system is also intended for programming of various types of PROMs. It is intended to be universal, i.e., suitable for development of systems based on various types of microprocessors, to allow growth and improvement of functions without changing the main structure of the system, to be easy to use and to allow communications with more powerful design systems. The processor used is a D3-28 microcomputer, interacting with the system being designed through a debugging

control device which includes a memory unit which emulates the programmable memory of the microprocessor. The microprocessor included in the microprocessor system interacts with the memory as with its own random access memory. The universality of the system is provided by adjusting it for each specific microprocessor, assigning the number of bits in a memory word. The system has been used to develop microprocessor systems based on the K580 and IK80A microprocessors and has been shown to be quite effective. References 10 Russian. [269-6508]

ONE METHOD OF DEBUGGING REAL TIME PROGRAMS

GALKIN, V. V.

[Abstract] A classification is presented of debugging devices and systems. Existing debugging methods are not suitable for real-time programs. There is interest in a new approach to implementation of debugging hardware based on the use of special devices connected to the computer bus. However, these devices also have limited functions. This article suggests a method of debugging intended for use with real-time control programs. The method is based on the use of special hardware completely separate from the system computer, including a debugger, control panel and special debugging software. The debugger includes a communications unit, hardware tracing unit and data processing unit, a specialized microcomputer based on a special high speed microprocessor chip set. Programs to be debugged function in the computer system naturally, with all information concerning the course of operations of the programs, including instruction addresses, operation codes and register statuses being transmitted to the bebugger for processing. This allows hardware tracing not only of the operation of programs but also of the history of the data processed. The device can record interrupts, note times of operations, control devices, provide tracing and snapshots of programs in operation. The debugger is under program control, allowing interactive and batch debugging. Figures 2; references 16: 12 Russian, 4 Western. [269-6508]

STATIC ANALYSIS OF PROGRAMS IN VEKTOR PROGRAMMING SYSTEM

KALYANOV, G. N.

[Abstract] A study is made of the structure, basic functions and design specifics of a static analysis system for programs written in the Vektor language, developed and implemented by the author on an PS-2000 multiprocessor

computer complex in the Vektor programming environment. Comparable systems are YaUZA-6, PET, SADAT, AFFIRM, DAVE, FACES and the IBM PL/I monitoring computer. The language is designed for automatic detection of semantic errors in early stages of debugging. Static semantic errors are classified as flow of control errors, errors in operations on data, data flow errors, errors in interfaces between modules and possible sources of side effects. The system presented is designed to detect and localize semantic errors in the early stages of debugging by static analysis. For the first time it implements this concept for a parallel computer system language with a single flow of instructions and multiple streams of data. The system is autonomous, independent of the compiler. It is oriented toward high level languages and can be used to analyze programs written in such languages at the level of their models. The system which took 14 man months to develop, has been in operation since late 1982 and has proven itself reliable, easy to use and easy to maintain. It was developed on an SM-2 computer, which, because it is used to control the PS-2000, provides for cheaper error detection than using costly PS-2000 time. The system comprises 20,000 SM-2 words, and 3-4 Vektor can be analyzed per second. Figure 1, references 11: 7 Russian, 4 Western.
[96-6508]

TOMLES--A PROGRAMMING SYSTEM USING THE LYAPAS-M LANGUAGE FOR THE YeS COMPUTERS

BYKOVA, S. V., GOLOVCHINER, M. N., ZHUKOVSKIY, O. I., NIKOLAYEVA, L. A. and PITOSIN, V. T.

[Abstract] The Lyapas-M language permits modular organization of programs. The rich capabilities of the language, its modularity, extensibility and orientation toward logic problems allow it to be used as the basis for development of design and diagnosis systems for discrete devices, information retrieval systems and for the creation of various modeling systems in combination with other languages such as Fortran. In development of the Tomles programming system, which operates in the batch mode under DOS YeS or OS YeS, primary attention was given to the aspects of system productivity, minimizing machine time, facilitation of debugging, development of diagnostics, improving ease of use, speed of data exchange with archives and the capability of operation with all YeS computer operating systems. The structure, functioning, and segments of the system are described. The Tomles system is used as a basis for creation of design and diagnosis systems for discrete devices and information retrieval systems at various vuzes and enterprises in Moscow, Minsk, Sevastopol', Tallin, Kazan, Novosibirsk, Omsk and Tomsk. It has served as the basis of TRASSA, for automated design of printed circuit boards; educationally-oriented interactive system ABITU RIENT-T; and a digital modeling system for collection, processing and representation of oceanographic information. Figures 2, references 8 Russian.
[96-6508]

THE PARES SYSTEM: ARCHITECTURE AND CAPABILITIES

KRAKHT, V. A., EYVAK, Yu. E. and VASSIL', M. Kh.

[Abstract] The PARES software system was developed at the Tallin Polytechnical Institute for the YeS computers (using OS) and is a combination of a database management system (DBMS) and data processing programming system. It is oriented toward the creation of data processing systems with an integrated data base in which, in addition to traditional reference functions such as output of responses to inquiries and generation of lists and reports, various tasks must be performed such as planning, control and optimization. The database structure utilizes a relational model, in which each element of the model has a certain set of attributes characterizing the given object or relation. The system operates with two major input languages, the DADEL data description language and the DAMAL programming language, both developed especially for this system. The software includes interpreters for all the languages, a central monitor, communications processors, a verification processor, a set of systems subroutines and functions. Development of data processing systems, construction and implementation of data bases are described. Brief programming samples are presented. Figures 4, references 7: 4 Russian, 3 Western.
[96-6508]

BUSIC--A DIALOGUE SYSTEM WITH A LANGUAGE PROCESSOR FOR ADJUSTING AND TESTING OF EQUIPMENT

IOFFE, A. V. and TALNYKIN, E. A., Novosibirsk

[Abstract] The BUSIC dialogue programming system is described, intended to provide for operation with equipment in a step-by-step mode or under the control of programs of arbitrary complexity. The system is similar to classical interactive language systems for engineering calculations such as BASIC and FOCAL. Its advantage is that of having standardized facilities for working with hardware and simple general purpose program structures. The system is oriented toward a common bus architecture allowing natural standardization of access to equipment by memory mapping. Programs in the system are compiled to allow real time operation with peripheral hardware. Instruction lines typed in from the console are immediately executed unless they begin with a number, in which case they are stored in RAM as a program to be run. Instructions can be drawn from a disk file for indirect execution. Examples of command syntax in the line are presented, as well as a simple program, looking very much like a short BASIC program. The article is an informal presentation of the most common decisions made in development of the language.
References 3 Russian
[147-6508]

THE AUTO-ANALYTIC SYSTEM

ARAYS, Ye. A.

[Abstract] A description is presented of the general characteristics of the
Auto-Analytic system which is designed to perform analytic and numerical
analytic calculations on a BESM-6 computer. The system, under development
since 1970, provides for simultaneous operation of system programs and practi-
cal applications. Supporting effective dialogue operation, Auto-Analytic
allows the user to input equations or programs. The dynamic information
exchange apparatus with peripheral storage allows complex algorithms to be
computed in spite of limited memory capacity. Auto-Analytic allows combined
utilization of both universal and special computer equipment. The input
language can be dynamically expanded by inclusion of macros. Auto-Analytic
can effectively implement numerical-analytic algorithms, with analytic expres-
sions converted to working programs. The output can be translated to FORTRAN.
Application programs have been written in Auto-Analytic for modeling of complex
technical devices. The structure of the system and output language are
described. Future development of Auto-Analytic will include increase efficiency
in working with rational numbers, as well as the development of numerical
analysis algorithms. A YeS computer version of Auto-Analytic is now in
development. References 16: 13 Russian, 3 Western.
[233-6508]

SOFTWARE FOR A LABORATORY AUTOMATION SYSTEM

ANIKIN, A. A., PESLYAK, N. M., SOKOLOV, A. A. and SOKOLOV, A. P.,
Novosibirsk

[Abstract] The Institute of Automation and Electrometry, Siberian Division,
USSR Academy of Sciences (SO AN SSSR), uses a laboratory automation system
based on the micro-CA-MAC-lab equipment, which includes an 'Elektronika-60'
computer with 28 K words memory, a display unit, floppy disk drive, printer,
video display and plotter. Additional modules can be plugged into what
amounts to a personal laboratory computer as required by the task at hand. A
telegraph interface connects the laboratory system to the Nord-10 multiuser
computer at the laboratory. The software is based on the RAFOS (RT-11)
operating system, supplemented by a full screen text editor TED, which is
widely used in SO AN SSSR institutes. Programs are briefly described which
supervise the conduct of experiments, process data and numerical results,

receive data input from the terminal, read and write data on floppy disks,
merge files and draw graphs. These programs have been tested for an extended
period in the laboratory, allowing debugging and selection of optimal solu-
tions.
[147-6508]

STRUCTURING MACROASSEMBLER PROGRAMS IN THE YeS OS

KAGANSKIY, I. M., Novosibirsk

[Abstract] A group of a few dozen macros for use in Assembler/E is described,
intended to assist in the development of structured assembler programs for the
YeS computer operating system. An example of description and calling of pro-
cedures is presented to illustrate the technique of segmenting structured
assembler programs. The set of macros was implemented in DOS ASVT and OS YeS
beginning in 1976, at first on an experimental basis. The macros, now
rewritten into Assembler/F for OS YeS are a convenient tool for description of
structured assembler programs. The IBM set of macro facilities is widely used
for structured programming. Analysis of previous studies and several years
operation of the macros here described have confirmed the effectiveness of
this approach to structured assembler programming. Basic functions include
if-then-else, select, do loops, and so forth. References 17: 16 Russian,
1 Western.
[147-6508]

PROBLEM-ORIENTED SYSTEM AS A MEANS OF A PAPERLESS PROBLEM SOLVING

YUSHCHENKO, Ye. L.

[Abstract] A brief history of the development of compilers and higher level
languages is presented, demonstrating that the first automatic generation of
a translator from its description was developed in the Soviet Union in 1959,
three years before such programs were available in the West. The article then
analyzes the experience of development of means of automation of programming
over the last twenty years and formulates the basic tasks of fundamental
research for the solution of the multifaceted problem of improving the man-
machine interface to increase 'paperlessness' in the solution of computer
problems. The concept of specialized programming languages for specific prob-
lems is examined in depth. ADA is recognized to be a worthwhile programming
language, particularly due to its clarity and applicability for large,

multi-person programming projects, which will bring about its wide use in the near future. The major goal of systems programming for the next twenty years will be the support of paperless problem solving, in which people will no longer be equipped with tools acting independently. All information streams will form closed loops not involving the intervention of man. This will allow major increases in productivity as human bottlenecks are eliminated.
Figures 4, references 33: 28 Russian, 5 Western.
[225-6508]

COPROGRAMS IN OS YeS

NOVIKOV, B. A. and ROMANOVSKIY, I. V.

[Abstract] In traditional systems, when a procedure is called the calling procedure stops, then restarts from the calling point after completion of the called procedure. The called procedure is performed clear through each time called. In coprogramming, each procedure acts as a calling procedure, i.e., stops then restarts from the calling point as necessary, establishing 'long-term' connections between procedures, significantly decreasing expenditure of computational resources in the transfer of control as procedures are called. The coprogramming mechanism has been implemented in the operating system OS YeS by means of a few small Assembler subroutines which define the specifics of connections between procedures and memory allocation control. The copro-gram apparatus has been implemented for an optimizing PL-1 compiler and for FORTRAN. A PL-1 Steiner tree program is presented and discussed illustrating the principle. On a YeS-1033 computer, the program can run in 1 minute 16 seconds, as opposed to 2 minutes 47 seconds without coprogramming.
References 6: 5 Russian, 1 Western.
[225-6508]

CONSTRUCTION OF A TRANSLATOR FOR MULTIPROCESSOR COMPUTER SYSTEMS. PART II

BABICHEV, A. V., LEBEDEV, V. G., PARSHENTSEV, V. V., PRONINA, V. A. and TRAKHTENGERTS, E. A.

[Abstract] Without any introduction, the article jumps right into Section 4 of a continuing discussion of design of a translator (compiler or interpreter) for multiprocessor computer systems. Section 4 discusses making source code parallel in the process of translation, including paralleling of cycles and linear segments and determination of parallels among individual program seg-ments with the formation of parallel branches. Greatest attention is given to

paralleling of cyclical segments (loops), since improvements in efficiency of these program segments yield the greatest gain in speed and efficiency. Theoretical results are presented which can be used to design the loop paralleling segment of the translator. It is assumed that the loop is tightly nested, the body of the loop being a sequence of assignment commands, although the theorems derived apply to all loops. Results are presented without proof. References 7 (numbered 9-15): 4 Russian, 3 Western.
[225-6508]

SEPARATE COMPILATION MECHANISM IN ADA LANGUAGE PROGRAMMING SYSTEM

GORBUNOV, A. B.

[Abstract] The problem of separate compilation for the ADA language is studied, ignoring generic units. This reduces the problem to the performance of three tasks: 1) control of compilation sequence; 2) support of semantic analysis of connections between compilation units; and 3) use of compilation units from other program libraries. A method is suggested for considering connections between compilation units allowing the transition to be made from connections between names in compilation units to relationships among compilation units. The relationships are used to introduce the concept of recompile tactics, demonstrating that recompile sequence control can be reduced to the application of two such tactics. A method is suggested for using units from other program libraries based on access to them by reading, avoiding duplication of intermediate representation of compilation units in the library and transforming the quadratic variation of information volume concerning relationships among units in program libraries to a linear variation as a function of the number of such units. The mechanism of separate compilation described here is based on the use of libraries of intermediate tree-form representations of compilation units, divided by library files into relatively closely related internal and relatively weakly related external library segments. References 4: 2 Russian, 2 Western.
[233-6508]

METHODS OF CONTROLLING DATA STRUCTURES AND MEMORY IN A ELBRUS-SNOBOL
TRANSLATOR

BOLDINOVA, N. N. and SMERTIN, A. N.

[Abstract] An interpreted version of SNOBOL4 has been developed for the Elbrus
computer system. The complex operations built into the language cannot be
fully supported by the Elbrus instruction set and require considerable time
for software emulation. The SNOBOL4 interpreter handles PATTERN, EXPRESSION,
NAME, TABLE, CODE, EXTERNAL, INTEGER and REAL data types, the Elbrus operating
system being well-suited for management of variable-length data sets. The
central table principle used in previous interpreters for chain storage is
retained but an original list representation of chains, quite effective for
concatenation, selection and subsitution, is used. The other major data type
in SNOBOL4 is patterns, which have a complex tree structure and may contain
chains, primitive patterns and functions, value attachment operations, and
expressions, interconnected by the operations of alternation and concatenation.
The operations of interpretation and memory management are described.
Figures 3, references 9: 5 Russian, 4 Western.
[233-6508]

COMPOSITION AND FUNCTIONAL PROGRAMMING: A COMPARATIVE ANALYSIS

NIKITCHENKO, N. S. and RED'KO, V. N.

[Abstract] The task of this work is to compare composition programming and
the functional programming of J. Backus, two styles which are quite close at
the level of general principles but differ basically at the level of special
principles, which determine the specifics of the two styles. The general
principles of composition and functional programming are outlined, including
subordination, separation, functionality and compositionality. The basic
differences are based primarily on the selection of data structures--
sequences in functional programming, data names in composition programming.
It is stated that the lack of data names in functional programming is a short-
coming rather than an advantage. The construction of programs in the two
styles is compared. An example program is found to be easy and natural to
construct in composition programming, much more difficult in functional pro-
gramming, because sequence-type data structures are at a much lower level of
abstraction than named data structures. Functional programming can be con-
sidered as a particular, though not the most important, case of composition
programming; the composition style of programming cannot adequately be expressed
in the functional style. References 12: 9 Russian, 3 Western.
[284-6508]

PARALLEL POCKET SORTING

CHARNAYA, I. S.

[Abstract] A study is made of a sorting algorithm for a parallel OKMD
[single command multiple data] computer with k processors, total machine
memory M consisting of Mi memory capacity of each ith processor, sorting a
file of N elements. Each processor has local memory but can access any other
memory. The essence of the algorithm is as follows. Suppose $L \geqslant N$ is a
portion of memory subdivided into K identical areas called pockets. The
pockets are numbered from O to K-1. All elements of the file are assumed to
consist of an identical number of bits. By analyzing in each element the log
K high-order bits, we obtain for each element the pocket number into which it
should be placed. After all M element are placed in pockets, the contents of
the pockets are sorted. Since the pocket files are ordered with respect to
each other, the whole file is ordered. Two implementations of the algorithm
are discussed in detail, being compared to Bandet and Stevenson's 1978 IEEE
work on parallel sorting algorithms. When the file is assured to contain
normally-distributed elements and the limits are known in advance, the total
number of operations for algorithm 1 and 2 are on the order of

$$S_1 = \frac{N}{K} (1.1 \log N + 0.818 - 0.767 \log K)$$

$$S_2 = \frac{N}{K} (2.152 + 1.1 \log \frac{N}{K}) + 0.275 N.$$

Figures 4, references 4: 2 Russian, 2 Western.
[96-6508]

FORMAL TRANSFORMATION OF STRUCTURED SORTING ALGORITHMS

TSEYTLIN, G. Ye.

[Abstract] This article is dedicated to optimization of sorting algorithms
by the use of the apparatus of relationships developed within the framework
of the theory of modified systems of algorithmic algebras (SAA), oriented
toward formalization of parallel computations. Its major result is a formal
transformation of the known sequential algorithm for shuttle sorting to an
algorithm of asynchronous conveyor sorting. In the process of conversion, a
new algorithm for successive sorting is generated which is significantly
faster than shuttle sorting, as is confirmed by a practical experiment in

program synthesis. The results obtained illustrate the possibility of using the apparatus of relationships to optimize programs developed by the method of multilevel structural program planning. References 10 Russian.
[284-6508]

ORGANIZATION OF PIPELINE EXECUTION OF PARALLEL PROGRAMS

RYZHKOV, A. P.

[Abstract] Multiprocessor systems frequently use the pipeline principle of processing, in which at any moment in time different program sections running on different processors are involved in processing different segments of the input data stream, significantly increasing parallelism and decreasing processing time. In this article, bilogic program models are suggested for the description of pipeline processing programs. Additional conditions are described for starting the commands of an unambiguous (in terms of the history of variables) bilogic system to allow organization of pipeline processing and guarantee unambiguity of the pipeline program and agreement of the order of arrival of input data and the sequence of computation of values of variables corresponding to the input data by the program. A bilogic system refers to a labeled graph, the nodes of which correspond to the commands of the model. The maximum lengths of queues of values of variables possible in conveyor processing are not analyzed. The methods presented in this work can be used as the basis for an algorithm for operation of a monitor controlling the operation of parallel program modules and organizing conveyor processing of input information. References 8: 6 Russian, 2 Western.
[233-6508]

BATCH PROCESSING SCHEDULING BOUNDARIES IN MULTIPROCESSOR NETWORKS

BAKENROT, V. Yu.

[Abstract] A previous article by the author studied algorithms for the distribution of batches of independent complex jobs among elementary processors in a multiprocessor network consisting of more than one multiprocessor machine, each of which contains more than one elementary processor. The present article presents a simpler method to produce an improved estimate of the effectiveness of RFBL algorithms for scheduling of jobs. References 3 Russian.
[277-6508]

PLANNING OF PARALLEL PROCESSING OF INFORMATION-COUPLED PROBLEMS IN A
HETEROGENEOUS COMPUTER SYSTEM

VISHNYAKOV, V. A. and GERMAN, O. V., Minsk

[Abstract] Two models of operational control are analyzed for heterogeneous
computer systems. The major accent in design is given to decreasing short-
comings of previous control systems, including cumbersomeness and slowness.
The basis of the models suggested for an operational control system for
information-coupled problems is the criterion of step-by-step optimization,
which allows rapid distribution of available independent operations consider-
ing a minimax criterion of working time. An experimental example demonstrates
the superiority of the new algorithms over existing ones.
References 6 Russian.
[255-6508]

THE PROBLEM OF OPTIMIZING SCHEDULES IN A MULTIPROCESSOR SYSTEM

VARAKIN, A. S., DANIL'CHENKO, A. M. and PANISHEV, A. V., Zhitomir-Khar'kov.

[Abstract] A study is made of the minimax problem of composing a schedule
for a system performing n operations and consisting of n + 1 processors of
two types. A function is derived which describes the time required for the
system to perform the sequence of operations, and the task of minimizing the
function, assigned in the set of all permutations of 1, 2,..., n is studied.
References 5 Russian.
[255-6508]

SPECIFICS OF ORGANIZATION OF TEST POINTS ALONG THE TRAJECTORY OF A COMPUTER
PROCESS FOR ONE CLASS OF CONTROL STRATEGIES

BRODETSKIY, G. L., Kiev Construction Engineering Institute

[Abstract] The purpose of this work is to turn the attention of users and
developers of systems toward a peculiarity of timer-based control: within the

class of strategies of this type the value of the optimal period for storage of intermediate results is invariant relative to the value of the rate of performance of a task. This peculiarity provides certain advantages to such strategies when organizing test points in multiprocessor systems with parallel organization of computation. A system with periodic storage of intermediate variables controlled by a timer is analyzed, distinguished by the fact that during performance of the initial task the system functions in various modes, each with its own speed of performance of operations. Supplementary systems are studied with fixed modes of functioning and it is shown that in the class of timer-based controls the optimal period of storage is identical for all modes, i.e., is independent of the speed of performance of the task. References 4 Russian.
[282-6508]

EFFECTIVENESS OF PLANNING ALGORITHMS IN NETWORKS OF MULTIPROCESSORS

BAKENROT, V. Yu., Taganrog

[Abstract] Estimates of α are produced for planning of parallel batch processing of independent and interconnected complex tasks in a heterogeneous multiprocessor network with more than one elementary processor at each node. It is assumed that each node on the network consists of identical elementary processors, but that the elementary processors at different nodes may be different. The RFBL algorithm is generally preferable for use in the operating systems of multiprocessor networks of this type, while the RNBL algorithm is preferable in networks in which all elementary processors are of the same type. Estimates are produced for unreliable multiprocessor systems allowing selection of requirements for software and hardware fault tolerance systems. References 20: 14 Russian, 6 Western.
[255-6508]

MINIMIZATION OF MAIN MEMORY VOLUME IN SPECIALIZED MICROPROCESSOR SYSTEMS

YEDOMSKIY, Yu. Ye. and STOROZHIK, V. S.

[Abstract] Known methods of nontrivial distribution of memory, in which each program variable is allocated the space it actually requires rather than one location per variable, are cumbersome and complex, and their implementation requires large numbers of computer operations. The method suggested in this article is simpler than previously known methods and allows production of minimum RAM volume for rather complex programs written in programming

languages of any level. The goal is achieved by preliminary and significant reduction in the number of sets of simultaneously existing variables which must be analyzed. Any program can be represented as an oriented graph consisting of a set of nodes and a set of lines, each of which corresponds to a linear section of the program, within which all operations are performed in succession. The method includes the following stages: numbering of linear sections, establishment of relationships for each linear section, production of maximum estimates of the necessary memory volume for each linear section, and determination of the optimal memory volume for storage of the variables of the program. In a typical example analyzed in the article the memory requirement is reduced by a factor of five in comparison to the trivial distribution. Figure 1, references 2 Russian.
[277-6508]

PARALLEL SEARCH IN A DISTRIBUTED DATABASE

KERBEL', V. G.

[Abstract] A study is made of parallel search in a homogeneous MIMD network assuming that the time required to transmit a request from machine to machine is negligible in comparison to the time required to process the request by each machine. Parallel data processing is studied as a function of the nature of data distribution among machines in the network and the rules of servicing of requests in the computer system. The effectiveness of parallel search rules in the distributed database is studied as a function of the time required to process a set of requests, the completeness of the database, processing of requests where data are duplicated, time required to process an individual request as the system services a flow of requests and real-time servicing of a flow of requests by the system. The results of the work confirm the hypothesis that it is efficient to perform group servicing parallel data search when the load on the system is low. As the system becomes saturated with requests it is more effective to utilize pipeline servicing or pseudosequential search. Processing of a request in a single machine, then in the entire system, is justified only if the probability of finding the data in a single machine is known. The increase in this probability achieved by duplicating data does not decrease the time required to process a set of requests. Figures 3, references 7: 6 Russian, 1 Western.
[233-6508]

HIGH SPEED REGISTER SWITCHING ALGORITHM

KALYAYEV, A. V., BOZHICH, V. I. and GALUYEV, G. A.

[Abstract] The problem of development of variable switching structures is an important one in the design of microprocessors with sets of macro-operations, as well as multiprocessor computer structures with programmable architecture. This article suggests a modification of homogeneous switching register structures (HSRS) intended to acclerate the procedure of their adjustment to an assigned system of communications channels, since the time required to adjust a switch has a great influence on the speed of both the microprocessor and the entire system based upon it. A significant reduction in adjustment time of the HSRS is achieved by organizing potential coding of information in the first stage and utilizing asynchronous information transmission by properly changing the algorithm which controls the register. This is achieved largely by bypassing the delay element in the register during the adjustment phase. A slight complication in the algorithm of operation of the register involving changing of the switching function and introducing a blocking function allows organization of an accelerated switching tree construction procedure. Reference 1 Russian.
[225-6508]

ANALOG-DIGITAL CONVERSION ALGORITHMS WITH BILATERAL BALANCING OF CONVERTED SIGNAL

LAVRENT'YEV, V. N. and KLOCHAN, P. S., Institute of Cybernetics imeni V. M. Glushkov, Ukrainian Academy of Sciences, Kiev

[Abstract] A study is made of analog-digital conversion algorithms with bilateral balancing of the signal being converted, and examples of practical implementation are used to show several means of improving the characteristics of analog-digital converters based on the algorithms. Bilateral balancing consists in that a code which is the digital equivalent of the analog signal being converted is defined as the difference between two codes obtained in the process of analog to digital conversion. The possibility of converting bipolar signals with monopolar quantity standards without the use of special approaches is one of the major advantages of the method. Use of this principle allowed a decrease in zero drift from 0.5 mV to 50 microvolts with a +10V comparator input signal, decreasing ADC error by a factor of more than two. Figures 4, references 4 Russian.
[251-6508]

ALGORITHM FOR COMPUTING PATTERN RECOGNITION ESTIMATES

ZADOROZHNYY, V. V.

[Abstract] A model is suggested for computation of estimates for the
recognition of standard format patterns. Previous studies have attacked the
same problem, representing the standard objects and object to be recognized
as linear sets of characteristics. However, images are naturally coded as
matrices, the elements of which are $\{0,1\}$ for black and white images or ele-
ments of an alphabet of K characters. Therefore, the family of reference
sets should be significantly changed. Rectangular submatrices of the matrix
encoding the image are considered as such families. This requires the crea-
tion of new methods and algorithms for development of effective formulas for
the computation of estimates. Models of computation of estimates for objects
which can be represented as matrices of standard dimensions are described.
Effective equations for the computation of estimates are then derived. The
algorithms described can be easily implemented and allow computation even with
large files of initial data on standard patterns and patterns to be recognized.
Implementation in programs is not particularly difficult if programming
languages such as LISP which are designed for list processing are used.
References 3 Russian.
[225-6508]

ONE APPROACH TO THE PROBLEM OF CONSTRUCTING EFFECTIVE RECOGNITION
ALGORITHMS

ALEKSANYAN, A. A. and ZHURAVLEV, Yu. I., Yerevan, Moscow

[Abstract] A study is made of a model of recognition and classification
algorithms of the type described in detail in a previous work by one of the
authors. A rather general approach is suggested to the problem of effective
computation of estimates. It is found that the possibility of effective
implementation of estimate-calculation type algorithms depends essentially on
the selection of the system of reference sets. Measures are suggested which
describe the simplicity and symmetry of the system of reference sets, and the
properties and behavior of ranks of systems are studied for set-theory opera-
tions when groups of isometric permutations are applied. References 1 Russian.
[286-6508]

ASSOCIATIVE SUMMARIZATION ALGORITHMS

BAGOTSKAYA, N. V., VAYNTSVAYG, M. N., DIMENTMAN, A. M., deceased,
LOSEV, I. S., Moscow

[Abstract] A model problem is used to demonstrate how the construction of
laws and their utilization can occur when the input of an artificial intelli-
gence system receives a continuous sequence of symbols not preliminarily
broken down into examples and its task is to predict the continuation of the
sequence. The learning system is implemented in an associative memory plus
processor system allowing learning and the solution of many problems in real
time. The memory plus processor is based on a linearly ordered sequence of
processors, each of which is connected to its immediate neighbors plus a
bus common to all processors. The instantaneous symbol sequence is recorded
in memory in the order of its arrival. Implicative rules are formulated and
used to predict subsequent symbols of the process. A learning process does
not involve sorting, so that it can be implemented on an associative parallel
system such that the learning time is proportional to the length of the learn-
ing sequence. Two algorithms are suggested and tested with model examples.
Although the basic purpose of construction of the algorithms was creation of
an artificial intelligence system, they can be used themselves in practical
pattern recognition problems. References 5: 3 Russian, 2 Western.
[255-6508]

ADDRESSLESS INFORMATION PROCESSING FOR THE SOLUTION OF SCANNING PROBLEMS

BYSTROV, V. N.

[Abstract] A discussion is presented of the problems which arise in the solu-
tion of scanning and selecting problems such as in the development of class-
playing programs. In order to reduce the tree of possible moves among which
a selection must be made while retaining its depth (number of moves in advance
analyzed), a method is sought for storage of information in a fixed memory
volume such that regardless of the quantity of information, all available
memory is used each time. Reading of information is also associative. The
difference between the addressed and this addressless prinicple of information
storage is compared to the difference between a photograph and a hologram. A
nonlinear method is suggested for conversion of information, with an address-
less method of storing the information. Recording of a single pair of move
positions in a simple game involves computation of the elements of a matrix
such that all memory locations are used to record an arbitrary number of

moves, rather than one location per move. Since the 'hologram' of memory
after each move either corresponds with a previously recorded hologram or does
not correspond to any previously recorded hologram, it includes certain
generalized information concerning all previous moves recorded in the hologram,
and thus is a method of storing generalized experience such as that used by a
chess player to limit the range of search for his next move. An experiment
with a much simpler game similar to tic-tac-toe showed that the use of
addressless processing can significantly reduce the size of the selection
tree of moves. References 6 Russian.
[225-6508]

AUTOMATED DIGITAL FREQUENCY ANALYSIS SYSTEM SOFTWARE

BUDNIKOV, K. I., IVANCHENKO, A. Ya. and PESLYAK, P. M., Novosibirsk

[Abstract] The software used with the 'Yenisey' digital frequency analysis
system, which runs on the Micro-CAMAC-lab, using the 'Elektronika-60' micro-
computer with floppy disk storage, consists of two parts: system software and
programs for automation of measurement procedures. System test programs are
written in CATY-M, a BASIC-like language used to program CAMAC equipment. The
large programs allowing the hardware of the system to be used for test measure-
ments are written in PASCAL under RAFOS. Each of the programs is described
and conditions under which they are used are noted. Extracts from the pro-
grams are presented. Measurement of frequency characteristics of a test
object is performed in several stages, including calibration of the measure-
ment apparatus, measurement and documentation of measurement results.
References 3 Russian.
[147-6508]

ADAPTATION OF STOCHASTIC SEARCH METHODS IMPLEMENTED IN A HOMOGENEOUS
COMPUTING ENVIRONMENT UNDER CONDITIONS OF UNCERTAINTY

VOLK, N. N., GROPPEN, V. O. and TRAKHTENGERTS, E. A.

[Abstract] A study is made of the effectiveness of implementing the Monte
Carlo method in a homogeneous computing environment with a common memory field,
having m processor elements and v control devices. Each can control all
processor elements. Problems which can be reduced to the search for a certain
quantity z calculated on the basis of a continuous function $F(x)$ defined over
an interval (a,b) are studied. It is assumed that quantity z can be defined
on the basis of quantities Z_i computed by the same method using the same

function F(x), defined in the interval (ai,bi), i = 1,2,...v. Adaptation is
performed by redistribution of processor elements among branches during the
course of search as information on the problem being solved is accumulated.
An ES-1020 OS 4.1 PL/1 simulation model was used to study the proposed method.
Figures 4, references 8 Russian.
[96-6508]

APPLICATIONS

PERSONAL MICROCOMPUTERS FOR ELECTRIC POWER NETWORK ENGINEERS AND
TECHNOLOGISTS

SHCHERBINA, Yu. V., Doctor of Technical Sciences Professor, BANIN, D. B.,
Candidate of Technical Sciences, Docent, and KHOMENKO, O. V., Engineer, Kiev
Order of Lenin Polytechnical Institute imeni 50th Anniversary of the Great
October Socialist Revolution

[Abstract] An advantage of Ural-1, Ural-2, M-220, BESM-4 and other first and
second generation computers used in power system control was that programmers
and engineers could introduce changes directly into the work plan or change
data during the course of calculations, a capability lost in the batch mode of
YeS, M-4030, SM and other computers. A branch scientific research laboratory
of the Ukrainian Power Engineering Ministry, in cooperation with the Electric
Engineering Department of Kiev Polytechnical Institute, has developed the
ARMIT automated engineer-technician's work station for the solution of prob-
lems related to the control of the most commonly used "110, 35, and 10(6)
kV" electric power transmission networks. The workstation is based on the
widely available Elektronika DZ-28 microcomputer. When equipped with 32 kB
RAM, the computer can calculate networks of up to 1,000 nodes. ARMIT was
first introduced to electric power enterprises in 1983, and proved to be easy
to learn and use. Some ARMIT software, which is written in DZ-28 assembly
code, was developed by VUZ students. Foreseen is transformation of the
station into an intelligent terminal in a large network. Figures 2,
references 4 Russian.
[190-6508]

USE OF MICROPROCESSORS IN SCIENTIFIC EXPERIMENT AUTOMATION SYSTEMS

PILIPOVICH, V. A., YESMAN, A. K., YERMILOV, A. A. and SAVCHENKO, A. A.,
Institute of Electronics, Belorussian Academy of Sciences

[Abstract] The purpose of this work was to create a system using micro-
processor systems based on the KR580 series microprocessors as distributed

experimental data processing systems to be tied to a central minicomputer for processing of experimental data. The system included an IVK-2 measurement and computer system based on an SM-4, plus CAMAC modules to connect the minicomputer to the microprocessor systems, consisting of K1-20 microcontrollers. Use of the CAMAC apparatus allows the creation of analog systems based on other minicomputers which are compatible with CAMAC equipment. A structural diagram of the CAMAC module which interfaces the CAMAC bus to the microprocessor bus is presented. The software is briefly described. The use of the system to automate laboratory experiments has shown its high effectiveness. Figure 1, references 2 Russian.
[219-6508]

APPLICATION PROGRAMS PACKAGE FOR OPTIMAL PLANNING AT INDUSTRIAL ENTERPRISES

YEMELICHEV, V. A. and PAVLECHKO, V. A.

[Abstract] A package of applications programs (PPP OP) for optimal planning is described which implements methods of solution of various integer and linear programming tasks, including a method of constructing sequential plans, local-stochastic methods, an adaptive algorithm for solving linear programming problems with variables taking on values of only 0 and 1 and a direct simplex method with a special algorithm for processing of degenerate matrices. The programs automate all calculations involved in the process of planning, development and functioning of continuing optimal planning problems at enterprises in various branches of the economy. The program modules were written in Assembler and PL-1. The programs can operate independently or under the control of any program written in Assembler or PL-1 on the YeS computers under DOS YeS version 2.0 or higher or OS YeS version 4.1 or higher. The basic features which distinguish this new set of application programs from 1977 and 1979 versions of the same set include: automation of the stage of planning of the computer system structure and composition of functional software; development of algorithms and programs for automation of the interface between the database of specific ASU and the programs; automation of selection of the method of performing specific tasks as a function of their dimensionality, limitations and required solution accuracy. The package was worked by TsNIITU [Central Scientific Research and Design Engineering Institute of the Organization and Technology of Management] in Minsk, and is used by over 60 organizations. Figure 1, references 36 Russian.
[225-6508]

USE OF SELF-ORGANIZATION IN MODELING OF ECONOMIC SYSTEMS

MARCHEV, A. A., MOTSEV, M. R. and MYULLER, I. A., Higher Economics Institute imeni Karl Marx, Sofia, Bulgaria; Higher Economics School imeni Bruno Leushner, Berlin, GDR.

[Abstract] Two programs have been developed in Bulgaria and East Germany for self-organization of econometric models. The programs have a great deal in common: both programs consist of two main stages, self-organization of individual difference equations for each variable of the model and self-organization of the system of equations; in the first stage a multirow selection agorithm is used and preliminary selection of significant variables based on correlation criteria is possible; in the second stage the system of difference equations is formed using several of the best canned equations for each final equation, systems of equations of different dimensionalities are formed, and the final system of equations is evaluated based on a systems criterion, the minimum bias or contradiction with respect to set correlation coefficients. Experience has shown that it is best to begin by constructing simple, aggregate models of small dimensionality, then gradually increase the complexity of models by increasing detail in those parts of the model significant for the solution of the particular research problem at hand. A macroeconomic model of the economy of Bulgaria based on just five significant economic variables is described. The results of prognosis show that both of the programs developed yield good results. Subsequent improvements of the program should consider the algorithm of objective systems analysis to eliminate self-organization of contradictory equation systems not satisfying the system criterion of minimum bias. Figures 2; references 4: 3 Russian, 1 Western.
[251-6508]

AUTOMATION OF DEVELOPMENT OF AN INTEGRATED SYSTEM OF RESEARCH, DESIGN AND ADMINISTRATION IN NONFERROUS METALLURGY

KUNAYEV, A. M., ASHIMOV, A. A., MANIKONOV, A. G. and KUL'BA, V. V.

[Abstract] The creation of automatic design systems (CAD) is a complex, long-term process. Therefore, the development of the integrated system of research, design and administration of nonferrous metallurgy in Kazakhstan should be conducted in parallel with the creation of automated designed systems, allowing these systems to be used subsequently both to maintain and modify existing systems, and to automate the design of new, similar systems in

nonferrous metallurgy in the Kazakh SSR. The major stages in the design of the integrated research, design and administration system are listed and discussed. The process of automated design of the system, due to its incomplete formalization, is iterative in nature, requiring the use of dialogue procedures. A diagram of the automated system of research and design being used in this development is presented. Practically all stages of development are included, beginning with analysis, structuring of initial data and synthesis of the optimal modular block diagram of the data processing system and ending with debugging and introduction of the data processing system, including optimization of a number of parameters of the process of utilization and modification of the system. The use of the method suggested for automation of design has reduced the total time required for development and debugging of eight sets of application programs now in use by 20 to 30%, representing a time savings of 1-3 months per job, while increasing the quality of software and data used in the data processing system. References 15: 14 Russian, 1 Western.
[321-6508]

INFORMATION ACTIVITY IN THE UKRAINIAN ACADEMY OF SCIENCES SYSTEM

BELAYA, A. A. and KASHIRIN, Yu. P.

[Abstract] Scientific information activity in organizations of the Ukrainian Academy of Sciences includes library servicing, copying and reproducing work, editing and publication, translation, photographic laboratory work, popularization of scientific achievements, patent information and license activity, information reference services, analysis and summarization of information, archiving of information and other types of operations performed both within and without scientific and technical information departments in the organizations. The broadest range of various types of information operations is performed in the information subdivisions of organization in the section of physical-technical and mathematical sciences; the range is less broad in sections of chemical-technology and biological science and still less in the section of social sciences. The statistics of numbers of personnel involved, numbers of organizations with libraries and with broader scientific and technical information departments are discussed. The Department of Scientific Information of the Ukrainian Academy of Sciences encompasses various areas of operation intended to improve the effectiveness of the information support of the scientific community. References 5 Russian.
[328-6508]

PLANNING OF INFORMATION ACTIVITY IN ORGANIZATIONS AND ENTERPRISES

KEDROVSKAYA, L. G., NEMIROVSKAYA, V. S., UKHIN, Yu. Yu. and YUDIN, V. P.

[Abstract] In order to improve the existing system of planning of scientific
information activities, to increase effectiveness and quality of scientific
and technical information organs, on 7 June 1983 the State Committee of the
USSR for Science and Technology approved methodological instructions entitled
'Planning in the State System of Scientific and Technical Information.'
These instructions were developed in accordance with directive documents and
instructions on the improvement of the economic mechanism and of planning of
the economy. They consider the varied and useful experience of planning of
scientific information activity in branches which have been placed on
independent financing in this area of their activity. The purposes of the
new document are to increase the level of planning, establish a single sequence
of preparation and approval of plans, assure mutual communications among
planning, accounting, responsibility and evaluation of information activity.
The instructions establish the types and forms of plans, their structure
and sequence of formation. Some changes in the primary structure of plans
will result. Five-year and annual plans will include sections on information
support of program assignments, mutual exchange of scientific and technical
achievements, scientific and technical propaganda, the arrangement and develop-
ment of scientific information libraries, and scientific and methodological
work in the area of scientific and technical information. References 5 Russian.
[328-6508]

ONE SOFTWARE IMPLEMENTATION OF A DIALOGUE INFORMATION RETRIEVAL SYSTEM

KAVALERCHIK, B. Ya., BIRGER, F. V. and LOGINOV, K. K.

[Abstract] Many automated management systems, especially those created long
ago, no means were provided for one-line data retrieval. One possible version
of the design of a software dialogue information retrieval system using a
YeS-7920 display is described. The basis of the software is a control program
intended to allow multiple users to access the database of an automated
management system simultaneously while protecting data integrity, allowing for
easy error recovery and consuming minimum computer resources. Software
includes a query program, dialogue controller, error handler and file handler.
Full screen formatted output is supported. Dialogue information retrieval
systems using the software structure suggested have been developed for several
automated management systems and are in use at a number of computer centers.
References 8 Russian.
[233-6508]

MICROFILMING OF SCIENTIFIC AND TECHNICAL INFORMATION SOURCE DOCUMENTS WITH FEW COLORS

BRODOLIN, L. I., KAN, A. Z., KUZNETSOVA, S. I. and MARSHAK, I. I.

[Abstract] A study is made of the capabilities of monochrome microfilm apparatus for microfilming documents in which color is used to accent areas of text or diagrams, but in which precise reproduction of color is not essential. The quantitative characteristics of such originals passing through the microfilming service of the All-Union Institute of Scientific and Technical Information are described. Percentages of documents requiring additional processing to yield satisfactory microfilms in 50,000 pages of original documents are as follows: 1.1% originals with few colors, 0.4% full color originals, 0.9% originals in which color was highly significant. The use of color filters and exposure adjustment cannot always reproduce the information satisfactorily. Intermedidate electrophotographic copying can be used to avoid information loss, but requires additional consumption of paper and copying equipment. The most flexible and promising means of correction of images is digital image processing, which will require obtaining the appropriate equipment from other organizations. Figures 2, references 18 Russian. [283-6508]

ANALYTIC TRANSFORMS BY COMPUTER STATUS AND PROSPECTS

KAPITONOVA, Yu. V.

[Abstract] This article presents a brief review of the Soviet and American literature in the area of computerized analytic transformations, an area which has been under intensive study practically since the invention of the computer. Particular attention is now being given to the problem of implementing analytic (symbolic) transforms at the hardware or microprogram level, equipping computers with programming systems oriented toward the manipulation of non-numerical objects. Ideological work on automation of analytic transforms has moved from the creation of specialized programs for automatic performance of a comparatively narrow range of formula transforms to problem-oriented software and hardware systems designed for complex symbolic transforms used in the process of solving engineering and technical problems. Work has been developed most actively in the following areas: development of hardware for symbolic transforms; automatic of analytic transforms in the development of computers and their software; automation of analytic transforms in

mathematical research; development of automated means for analytic transforms; and creation of universal analytic transform programming systems. Major tasks include: development of effective algorithms; implementation of algorithms on computers considering the selection of suitable data structures; development of problem-oriented languages for analytic transforms; inclusion of analytic transform facilities in automated data processing systems; and organization of interactive man-machine operation in the process of performing analytic computations. The technique of analytic transforms is among the best developed of mathematical tools actively used in problem solving. Further development is a pressing task. References 106: 98 Russian, 8 Western.
[225-6508]

INTERACTION OF OPERATOR WITH CONTROL COMPUTER

PARASHCHAK, A. N., Engineer

[Abstract] The design and control software of an operator's panel used in a system for automatic control of the process of transport of petroleum are described. The hardware used is based on a model SM computer. The keyboard is divided into two areas; command input and status report request areas. The command input area is divided into several levels, and keys in the various levels must be pressed in the proper sequence in order to input a command. A block diagram of program flow and equations describing the control process are presented. The design of the control panel reduces the probability of operator error.
[258-6508]

DEVELOPMENT OF A TECHNOLOGY FOR PLANNING FUNCTIONAL ALGORITHMS FOR USE IN AUTOMATIC PROCESS CONTROL SYSTEMS

ZAYTSEV, V. G., ZALEVSKIY, Ye. A. and YEFREMOV, S. P.

[Abstract] This article discusses the composition of control algorithms, the sequence of which is determined by the algorithm for functioning of the control system, as opposed to the composition of specialized algorithms describing a selected type of situational control, method of organization of a data base or input-output procedure. Design of the algorithms of a system is reduced to planning of functional algorithms with subsequent addition of algorithmic structures containing the functions of special algorithms. This article suggests a regulated and interactive technology and method of design

(Russian acronym: RITM-design) for the functional algorithms of a process
control system. The process of design begins with determination of the output
material object of the technological process plus the composition and
required values of parameters characterizing the output material object
based on information from the technical assignment. The input material object
and material converter which converts the input object to the output object are
then defined. Parameters of the input object which influence the required
parameters of the output object are defined. The actions of the material con-
verter required to produce the desired conversion are determined. The preced-
ing material converter is then defined, and the entire sequence of material
converters and objects making up the technological process, as well as the
technological events reflecting the status of the material flow. Subsystems
are divided according to zones of functioning of the control system. Planning
of the functional algorithm then begins with interpretation of the abstract
descriptions corresponding to subsystems used in the control system. The
experience of using the new RITM-design method has shown a savings of design
time of 30%, achieved by allowing parallel work and the reuse of libraries of
design implementations. The quality of development is increased by system-
atizing and regulating the process of design based on systems analysis of the
object of control and the controlling portion of the system. Figure 1,
references 3 Russian.
[269-6508]

ANALYTIC CALCULATION OF OPTIMAL NONUNIFORM SORTING OF PARTS

SUMIN, V. V., KISLITSYN, A. B. and VOROB'YEV, V. I., Moscow Higher Technical
School imeni N. E. Bauman

[Abstract] A study is presented of the possibility of expanding the area of
application of analytic calculation methods for nonuniform sorting of parts.
The results allow simple analytic computation of the optimal boundaries of
size groups under rather general assumptions concerning the distribution of
part dimensions. The calculation of optimal sorting boundaries is reduced
to a sequence of selection of initial points for sorting, computation of
boundaries of dimensional groups based on one part and determination of related
dimensional groups based on a second part. The simplicity of this calculation
method allows it to be used as the basis for an algorithm for constructing a
sorting machine. Another advantage of the method is the possibility of a
priori determination of the area of its applicability. References 6 Russian.
[281-6508]

AUTOMATED INFORMATION-MEASUREMENT DEFECTOSCOPY SYSTEM

BEREZYUK, B. M., Engineer and SHUMKOV, Yu. M. Candidate of Technical Sciences

[Abstract] A software system has been developed to allow processing of defectoscopic measurements from a type K-489 multichannel digital voltmeter. The software system was used to accumulate test information for development of algorithms for rejection of defective products. The computer selected was the SM-4 which has good operating speed and a wide selection of peripheral devices. The common bus interface of this computer allows standard peripherals to be selected. In addition to standard peripheral input, output and storage devices, the machine is equipped with nonstandard information measurement and input devices and a television monitor controller. The input devices include a scanner, defectoscope and ADC. A block diagram of the structure of the measurement-information system is presented. Figures 2, references 3 Russian.
[258-6508]

DIAGNOSTICS OF A CODER-DECODER BASED ON READ-ONLY MEMORY DEVICES

AKOPOV, R. V., MARKARYAN, A. V. and CHAKHOYAN, L. M., Yerevan Scientific Research Institute of Mathematical Machines

[Abstract] A method is suggested for diagnostics with a ROM-based coder-decoder implementing Hamming code in which the H matrix consists of sub-matrices obtained by cyclic permutation of rows of any submatrix. The method is applicable to the class of coder-decoders in which each ROM implements coding of information according to a Kxn submatrix, while the number of sub-matrices is equal to the number of test bits, i.e., coder-decoders satisfying the condition $k = R/n$, where k and R are the number of test and data bits, and n is the number of address lines of the ROM. The method is demonstrated to be reliable. It is also applicable to coder-decoders based entirely on modulo two addition chips, though effectiveness is less due to redundant test words. Figure 1, references 5: 3 Russian, 2 Western.
[224-6508]

STUDY OF OSCILLATIONS IN NONLINEAR MULTIPLY CONNECTED SYSTEMS BY
CHARACTERISTIC TRANSFER FUNCTIONS METHOD

GASPARYAN, O. N.

[Abstract] The method of characteristic transfer functions is extended to the
problem of studying single-frequency oscillations in nonlinear harmonic
linearized multiply connected automatic regulation systems with arbitrary
numbers of inputs and outputs. Single-frequency balanced oscillations in
automatic regulation systems are studied for a system whose matrix structure
can be represented by a simple feedback loop. Oscillations are also studied
in monotypical regulation systems, in which the transfer functions of individ-
ual channels are identical, but the interconnections are described by a con-
stant numerical matrix, as well as circulant and anticirculant systems, such
as the simple symmetrical and antisymmetrical multiply connected systems
widely used in practice. Figures 4, references 5: 4 Russian, 1 Western.
[224-6508]

HARDWARE SELECTION AND ARCHITECTURE FOR MICROELECTRONIC HARDWARE
IMPLEMENTATION OF GAA METHOD ALGORITHMS

BELOZERSKIY, Ye. A., GOLIK, L. L., YELINSON, M. I., PEROV, P. I., SHAROV, A. M.
and YURACHKOVSKIY, Yu. P., Institute of Radio Engineering and Electronics,
USSR Academy of Sciences

[Abstract] A study is made of problems of hardware implementation of GAA
(Group Accounting of Arguments) method algorithms. They were created to model
complex objects which can be formulated as problems of restoration of a func-
tion assigned at a finite number of points. The work analyzes one GAA method
algorithm designed for the construction of models in the form of linear combi-
nations of input variables, either observed variables of the object or assigned
functions of these variables. The algorithm is iterative and allows signifi-
cant paralleling of the computational process, achieving good hardware
efficiency. Figures 3, references 18 Russian.
[206-6508]

METHOD OF DESIGNING RECURSIVE DIGITAL FILTERS FOR A DIGITAL SIGNAL
FREQUENCY ANALYSIS SYSTEM SPECIALIZED PROCESSOR

KOLESNIKOV, A. N., Novosibirsk

[Abstract] The method of designing analog band pass filters can be reduced to
successive connection of dipoles. A digital dipole can also be used as the
basic element in the design of digital filters. If a monotonic function of
frequency can be selected as the AFC argument over the range from 0 to π/T
and the structure of the AFC formula is similar to the structure of the AFC of
the analog filter of the same order, the procedure for design of a digital
filter can be significantly simplified. This article studies the task of
synthesis of a recursive digital low-pass filter best approximating an analog
Butterworth filter within the transmission band. The method involves the
minimum number of multiplications. Figures 2, references 3 Russian.
[147-6508]

STUDY OF COMPLEX TECHNOLOGICAL OBJECTS WITH PARTIAL PRECEDENCE ALGORITHMS

KAMILOV, M. M., ABDUKARIMOV, R. T. and UMEROV, Kh. U., Uzbek Scientific-
Production Association 'Kibernetika', Uzbek Academy of Sciences

[Abstract] Analysis of complex technological objects shows that the static
characteristics, complex functions throughout the entire range of change of
the vector of output variables, can be well approximated by simple functions
within individual subareas of the space of input variables. This article
studies the formal statement of the task of generating such an approximation.
Construction of a mathematical model of a complex object requires initial
data on the functioning of the object in the normal operating mode and selec-
tion of a set of random quantities with unknown distribution function in the
multivariate space of the model. The problem is solved in stages by dividing
the set of implementation into subsets and using recognition algorithms with
a 'teacher' to subdivide the set into subsets corresponding to stable function-
ing of the object. This study develops an algorithm for the second stage,
which is the most complex stage. References 5 Russian.
[262-6508]

TIME WINDOW WITH VARIABLE PARAMETERS NOT REQUIRING THE OPERATION OF
MULTIPLICATION

PETROVSKIY, A. A. and GANUSHKIN, Yu. A., Minsk Institute of Electronic
Engineering

[Abstract] One operation in spectral analysis of discrete signals by means of
fast Fourier transform algorithms which increases the computational complexity
of digital processing algorithms is multiplication of input data by a weighted
function called the time window. This article suggests a time window which can
be used in microprocessor signal digital processing systems without this sig-
nificant increase in computational complexity, since it does not require the
operation of multiplication. The window allows production of a satisfactory
quality criterion without encountering the limitations of other similar pro-
cesses including, in addition to the use of at least one multiplication opera-
tion, the need for significant memory volume to store window coefficients and
function tables, and difficulty in computing window coefficients, requiring
computation of trigonometric and spatial functions.
[188-6508]

FUNCTIONALLY EQUIVALENT TRANSFORMS OF ELECTRIC SCHEMATIC DIAGRAMS

KUKUSHKIN, B. A. and KHAMDAMOV, R. T., Leningrad Institute of Precision
Mechanics and Optics

[Abstract] A procedure is suggested for converting electrical schematic
diagrams to their functional and logical equivalents. An example of the
development of the method is presented using a bidirectional information trans-
mission channel (BITC), mounting connections and individual MOS transistors.
The general procedure for converting the electrical schematic diagram to its
functional-logical equivalent consists of the following five operations:
1) lay out the directions of transmission of signals in conductors; 2) replace
mounting connections in one direction with their logical AND/OR equivalent;
3) replace the BITC with two lines carrying signals in opposite directions;
4) if there is a series of controlled contacts in the BITC circuit, equate each
BITC equivalent to an equivalent controlled contact circuit; 5) replace the
bidirectional circuit by its equivalent. Figures 3, references 1 Russian.
[188-6508]

TANGENT-MULTIPLIER DIGITAL-ANALOG CONVERTER

SMOLOV, V. B., Leningrad Institute of Electric Engineering imeni
V. I. Ul'yanov (Lenin)

[Abstract] A number of hybrid information processing systems must perform the
operation of tangent multiplication. The required accuracy of this operation
is practically determined by the accuracy with which the input voltage is set.
This article studies the construction of hybrid devices on the basis of
approximation expressions and the application of these expressions to the crea-
tion of hybrid devices. A figure illustrates a tangent multiplying converter
with the minimum number of operational amplifiers, digital control con-
ductances, logical digital subcircuits and constant precision resistors.
Figure 1, references 2 Russian.
[188-6508]

ASYNCHRONOUS PROCESSES AND ANTITONAL CONTROL CIRCUITS. I. A
DESCRIPTION LANGUAGE

STARODUBTSEV, N. A., Leningrad

[Abstract] The purpose of the study of which this article is the first part
is to develop a universal formal method of synthesis of control devices made
up of logic elements to implement monotonic nongrowing boolean functions.
These systems, called antitonic systems, are of interest because most modern
integrated microcircuit production technologies allow two-level structures
only of monotonic boolean functions to be implemented without logical
inconsistencies. In this article, antitonic circuits with external inputs
and the corresponding signal change processes are analyzed. Simultaneous
changes in several signals are allowed in the circuits and the corresponding
processes are studied. It is presumed that the circuits consist only of and,
or and not elements. The language of description of the processes by which
signals change can be used to describe both the structure and the dynamics of
circuits. The language implements a model suitable for automation of the
synthesis of devices designed to control asynchronous parallel computational
processes. The language, an extension of the language of cyclograms, is based
on representation of processes as a graph or network, referred to as a T-
network. Examples of T-networks are presented. Figures 4, references 11:
10 Russian, 1 Western.
[255-6508]

NETWORKS

PARAMETRIC OPTIMIZATION OF A PACKET-SWITCHING NETWORK

SUSHCHENKO, S. P.

[Abstract] The operating characteristics of packet-switching data transmission
networks are largely determined by packet length and window size. The task
of selecting these parameters is complex. Existing methods of formal selec-
tion of parameter values are oriented toward unconditional optimization of one
criterion. In this work, to allow simultaneous consideration of both system
and user requirements, the compound criterion is constructed allowing produc-
tion of analytic estimates of the optimal packet length and window size to
achieve minimal mean time of delivery of messages through virtual connections
with slight deviations in potential throughput capacity of network connections
from their maximum values. Constructions are performed on the assumption of
moderate network load, allowing the interaction of information streams trans-
mitted by different virtual connections to be ignored. The method suggested
can be used in networks with large numbers of relay sectors. Its use is
particularly suitable when long messages dominate network traffic and there
is a low level of error in network communications channels, when the optimal
packet length based on the criterion of the data transmission system is
comparable to the size of subscriber messages but provides excessive delivery
time to consumer processes, whereas network parameters obtained by the present
method allow, by slightly decreasing the throughput capacity of connections
between nodes, achievement of a significantly reduced delay for long trans-
mission distances. Figures 2, references 9: 7 Russian, 2 Western.
[277-6508]

RELIABILITY OF DATA TRANSMISSION IN COMPUTER NETWORKS WITH RANDOM ERRORS

MANSUROV, R. M. and STOLOV, Ye. L.

[Abstract] The apparatus of Markov chains is used to study the reliability
of a procedure for monitoring message transmission in which the message field
is followed by a control word which consists of the remainder produced by
division of a polynomial constructed on the basis of the message field by a
known fixed m-power polynomial. Upon reception a polynomial constructed from
the control word is added to the message polynomial and the result is divided
by the m-power polynomial. If the remainder is zero, it is assumed that the
message has been received correctly. The probability of error for a typical
case is calculated to be 2^{-16}. References 4 Russian.
[277-6508]

THEORY OF COMPUTATIONS

SOLVABILITY OF THE PROBLEM OF EQUIVALENTS FOR SYNCHRONOUS DETERMINISTIC
AUTOMATA WITH STACK MEMORY

NEPOMNYASHCHAYA, A. Sh.

[Abstract] A new subclass of deterministic automata is defined, called
synchronous deterministic automata with stack memory (SDMP-automata). The
problem of equivalents is proven solvable for this new class of devices. The
major result proven is that for any SDMP-automaton M using a stack alphabet,

$$\Gamma = \Gamma_1 \cup \Gamma_2 \cup \ldots \Gamma_n \ G_m \in H_n.$$

The KS-language is given as an example of a language that is permitted by an
SDMP-automation. References 9: 5 Russian, 4 Western.
[96-6508]

IMPLEMENTATION OF PARALLEL DISCRETE CONTROL ALGORITHMS IN ASYNCHRONOUS
AUTOMATA

CHERMISINOVA, L. D.

[Abstract] When parallel control algorithms are implemented with synchronous
automata, the task of the designer is to construct codes of minimal length
such that the parallel states are encoded with nonorthogonal codes, non-
parallel states with orthogonal codes. When an asynchronous automaton model
is used, an additional goal appears--elimination of dangerous competition
between memory elements. An example of a control algorithm written in the
PRALU language is analyzed. The model is distinguished by the presence of
parallel states. A state coding matrix is derived for the automaton model
developed, 13 states being coded by six internal variables. References
6 Russian.
[277-6508]

COMPUTATIONAL STRUCTURES OF ALGORITHMS FOR FINDING PATHS IN A GRAPH

SEDUKHIN, S. G., Novosibirsk

[Abstract] A study is made of a systematic approach to the planning of
computational structures for finding the transitive closure and determining
shortest paths in a graph containing n points, optimal with respect to the
criterion AT^2, a measure of complexity of VLSI circuits which reflects the
compromise between cost of manufacture of the chip and cost of information
processing. The approach is based on formal determination of structural
computational circuits and subsequent space-time two dimensional, one
dimensional and cellular interpretation of these circuits as the corresponding
networks of a computer. It is shown in particular that with two dimensional
interpretation in a network of n x n computers the time complexity of solu-
tion of the problem is $O(n)$. It is noted that whereas for the coordinated
operation of a small number of computers it is effective to use global net-
work synchronization, with a larger number of high speed computers the
asynchronous principle of organization of local interactions may be preferable.
The computational structures produced in this article do not require global
synchronization and centralized control, since the activation of each computer
in the network can occur as input operands are received from neighboring com-
puters. Figures 3, references 9: 1 Russian, 8 Western.
[255-6508]

ONE METHOD OF REDUCING A PROBLEM OF LINEAR INTEGER PROGRAMMING TO THE
KNAPSACK PROBLEM

PAVLOV, A. A. and GERSHGORIN, A. Ye., Kiev Polytechnical Institute

[Abstract] A method is suggested allowing a problem in linear digital pro-
gramming of arbitrary form to be reduced to an equivalent knapsack problem.
The knapsack problem can be effectively solved by dynamic programming, group
minimization or special methods. The coefficients of the knapsack problem
obtained do not take on astronomical values as the input variables increase,
allowing precise solution of the initial linear integer programming problem
even where its dimensionality is rather high. Reference 1 Russian.
[251-6508]

ADAPTIVE CONTROL WITH FINITE AMPLITUDE-PHASE CHARACTERISTIC (APC) AND
ZERO TRANSFER FUNCTION

PECHUK, D. V., Institute of Automation imeni The 25th CPSU Congress, Kiev

[Abstract] Results of previous works are expanded and the problem of
synthesizing a control system with qualitatively new propertics is solved,
allowing the synthesis of closed control systems with arbitrarily great
stability reserve. The use of the zero transfer function allows effective
balancing of nonregular pulse interference. An experimental study of the
functioning of closed systems confirmed the correctness of the results
obtained and the high effectiveness of control with finite APC. Figures 1,
references 3 Russian.
[251-6508]

APPROXIMATION AND PRECISE FORMATION OF BOOLEAN FUNCTIONS OF MANY VARIABLES. I.
MEMORY REQUIREMENT AND ACCURACY OF APPROXIMATION

RADCHENKO, A. N., Leningrad

[Abstract] A study is made of a system S which transforms input information
sequence X to output sequence U. The information processing system might be
a translator, telegraph operator or robot. The task of the article is to
design automaton A which replaces the initial system S by remembering the
relationships between the binary sequences X and U and can reproduce the latter
upon repetition of the former. The possibility is proven of forming associa-
tive connections between binary texts by means of learning algorithms. The
associative connections are implemented in the form of a boolean function,
the output function of the automaton, this function being subject to a priori
minimization. The minimization of disjunctive threshold forms of such func-
tions is studied and the existence of minimal representations dependent on the
threshold and invariant to the number of variables is proven. A priori
redefinition of output functions may cause false reproduction of an
insignificant portion of null symbols of the associated text. Errors are
minimized by assigning an optimal threshold and matching the metric properties
of the output and transition functions. Given fixed accuracy, the memory
requirement is directly and linearly related to the length of text converted.
With fixed memory capacity, the error increases as it is filled. Damage to
the information carrier causes a decrease in reproduction accuracy.
Figures 4, references 7 Russian.
[255-6508]

ANALYSIS OF TRAJECTORY SENSITIVITY OF ADAPTIVE STOCHASTIC CONTROL
SYSTEMS

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[Abstract] This article is dedicated to development of a method for analysis
of trajectory sensitivity of stochastic adaptive systems and its application
to the investigation of adaptive systems with a stochastic standard model
and with an identifier, as well as systems tracking the model and traditional
linear systems with feedback. It is found that the stochastic trajectory
sensitivity of the output coordinate vector is higher in a system in which
the determinant of the covariation matrix in the denominator of the expression
derived is higher. A criterion is presented for comparison of the sensitivity
of two systems, such that comparison of the sensitivity of two adaptive systems
is reduced to integration of ordinary differential equations and determination
of the value of one function for each moment in time by means of two equations
presented in the article. References 15: 13 Russian, 2 Western.
[282-6508]

EDUCATION

EDUCATION OF SPECIALISTS AT THE UNIVERSITY: WHO WILL DEVELOP A COMPUTER PROGRAM?

[Article by S. Yermakov, doctor of physical and mathematical sciences, professor, laureate of the USSR State Prize, dean of the Leningrad State University imeni A. A. Zhdanov mathematics and mechanical engineering department]

[Text] According to specialists, a new, previously unused parameter for measuring the state's economic potential will be of the utmost importance in the near future, along with the amount of electric energy produced or the smelting of steel: the quantity of software produced.

This is because the cost of software for present-day integrated production complexes comprises up to 50 percent, on the average, of these complexes' overall cost. Thus, an "immaterial" phenomenon such as a program recorded on tape or magnetic disk turns out to be no less (and sometimes more) costly than the most advanced and complex hardware such as robots, numerically controlled machine tools and computers. These programs can contain 100,000 and more (!) commands, although the crux of the matter goes beyond the size of programs for machine-intensive production. It is their special complexity, their "architecture", the need to make them compatible with the most diverse of computer models, that calls for the creation of a multitude of special programs called "translators".

That is why one of the most important questions that the production of software must contend with is the problem of personnel. The number of programmers in many large enterprises has grown five-six fold in the last five years. Only new higher quality specialists can increase the productivity of programmer teams.

Our department is producing these "quality" specialists. We now have 50 upperclassmen, and we will be accepting 75 more this year, while increasing this number to 100 next year.

It is clear, though, that this increase in numbers is totally insufficient for producing a "programming" base. The department's graduates are, in a manner of speaking, "hot" even at present, with the demand for these specialists currently coming from only the largest enterprises that are starting to implement elements of flexible production on a broad scale. Other collectives

will have to deal with the need to greatly improve software standards and complexity in the near future. It is therefore essential to be concerned ahead of time not only about broadening the scope of training for highly qualified systems programmers but also to make sure that each of them is carefully and wisely used.

Let me explain this reasoning. The standard guide to professions now contains the professional specialty "applied mathematics", which the graduates of many Leningrad technical institutes receive, such as those of the Shipbuilding Institute, Polytechnical Institute imeni M. I. Kalinin and a number of others. At Leningrad State University, for instance, two departments, ours and applied mathematics, produce future engineers with this specialty recorded in their diploma. The diploma is one thing, but the heart of the matter is entirely different: our graduates work on the design of program packages, so-called "application programs", that solve real production problems. However, some enterprises, in "ordering" specialists, actually go by the guide's specialty classification, disregarding the reality of the situation. We are engaged in efforts to explain the situation to these enterprises, but the fact remains: a most important and essential professional specialty for the economy "might as well not exist", and this leads to far from trivial consequences, and for the educational institution as well.

It seems that the Ministry of Higher Education and Gosplan USSR would be able to expeditiously solve this problem. This new and recently developed professional specialty, so vital to our country, needs to be "enfranchised". This would allow enterprises to more carefully plan their personnel policies, and higher educational institutions to modify their educational programs accordingly, which would improve the quality of training.

At the same time, the creation of a new professional specialty and its teaching at a large number of institutes will place a great responsibility on higher educational institutions. The pedagogical underpinnings of the academic process must first be seriously thought out because, without highly qualified instructors, success will not be attained. We know this from personal experience.

I believe that it would be useful to train these instructors in well-directed graduate programs at Leningrad State University and the best technical institutions of higher learning, to lay the groundwork and set the structure of these future instructional departments during the training process. The experience already exists: we previously sent whole teams of young scientists to the cities of Syktyvkar and Ustinov; prestigious schools of advanced mathematics have now developed there.

Finally, the most serious attention should be paid to material support of the educational process. We have experienced considerable difficulties because of a lack of the latest computer technology, which is totally indispensible for the practical and theoretical training of specialists. The institution of close ties with Elektrosila and a number of other associations saved the situation. A scientific subdivision of our department, equipped with the latest computers and peripherals, has been created jointly with these large enterprises. It would seem that maximal convergence with industry is the way to improve the quality of the educational process, given the increasing demands being placed on higher educational institutions.

The situation with our students is rather complex, too. The percentage of Leningrad residents among our first-year students has fallen sharply. There are a number of reasons for this, but the main reason is the inadequate level of mathematical training in many Leningrad schools. We are placing our hopes on school reforms, in particular the institution of a secondary-school course in informatics that starts on September 1 of this year. At the same time, it must be understood that the appearance of a new subject in the school schedule in and of itself will not solve this problem; what is needed are intensive and well-directed efforts on the part of faculty.

These are the problems that arise in dealing with the training of highly qualified computer software specialists. They are not simple. But the interests of the economy demand that they be solved.

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CONFERENCES AND EXHIBITIONS

SEMINAR ON MICROCOMPUTER PROGRAMMING LANGUAGES AND METHODS OF THEIR
IMPLEMENTATIONS

POTTOSIN, I. V.

[Abstract] The seminar on microcomputer programming languages and methods of
their implementation was held from 28 through 30 June, 1983 at the Academic
Village in Novosibirsk in the Computer Center of the Siberian Division, USSR
Academy of Sciences. More than 50 specialists from 30 organizations took
part in the seminar, hearing sixteen reports dedicated to various approaches
to programming languages and methods of their implementation as applicable to
microcomputers. Many reports discussed systems which have been developed for
the creation of microcomputer software and preparation of microprograms based
on languages at the assembler and macroassembler level. The problem of the
level of languages was among the most important problems discussed in the
reports and discussions. Basic principles of the KOMPAS AND YAKHONT systems
were outlined, yielding non-assembler, rule-based approaches to program
development languages. The promise of this approach was noted. It was sug-
gested that programming languages be converted to problem-solving languages.
The possibility of hardware implementation of FORTH was discussed. Many other
problems were discussed.
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